WEST Search History

DATE: Friday, September 12, 2003

Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=ADJ		
L10	L6 and (web or email or E-mail)	26	L10
L9	L7 and @AD<20000810	1	L9
L8	L7 and l6	0	L8
L7	video near (stream or streaming) near8 (embedd or embedding or embedded) near8 (web or email or E-mail)	8	L7
L6	L5 and l4	112	L6
L5	video near8 (player or decoder)	33897	L5
L4	L3 and l2	189	L4
L3	(gigital or digitized) near8 video near8 (distribution or streaming or stream)	618	L3
L2	L1 and @AD<20000810	5719	L2
L1	video near (stream or streaming)	10841	L1

END OF SEARCH HISTORY

WEST

Generate Collection

L9: Entry 1 of 1 File: USPT Nov 5, 2002

DOCUMENT-IDENTIFIER: US 6477550 B1
TITLE: Method and system for processing events related to a first type of browser from a second type of browser

Application Filing Date (1):
19990316

Detailed Description Text (17):
When a client computer displays a web page, a user may use an attached input device such as a mouse or a key board to instruct the browser to perform further actions such as accessing other web pages for which links are provided in the displayed web page, or download and play an audio or video stream embedded in the web page. These actions performed by a user create what are known in the client-server computing jargon as "events," which can be acted upon by code in a computer, if the computer is configured to do so.

L10: Entry 2 of 26 File: PGPB Dec 13, 2001

DOCUMENT-IDENTIFIER: US 20010052001 A1
TITLE: DIGITAL DEPARTMENT SYSTEM

Abstract Paragraph (1):
A digital department system is disclosed. The digital department system of the present invention includes a network management center, a network operating center that is coupled to the network management center, a multimedia server, a multicasting transmission medium coupling the network operating center and the multimedia server, a listening post coupled to the multimedia server by the network, and one or more audio/video display capable of displaying video and capable of playing audio, the audio video display coupled to the multimedia server by the network. The audio and video content are stored in digitized files on the multimedia server for distribution throughout the site via the network.

Application Filing Date (1):
19980807

Summary of Invention Paragraph (13):
[0011] In one embodiment of the present invention, a digital department system is provided. The digital department system of the present invention includes a network management center, a network operating center that is coupled to the network management center, a multimedia server, a multicasting transmission medium coupling the network operating center and the multimedia server, a listening post coupled to the multimedia server by the network, and one or more audio/video display capable of displaying video and capable of playing audio, the audio video display coupled to the multimedia server by the network. The audio and video content are stored in digitized files on the multimedia server for distribution throughout the site via the network.

Detail Description Paragraph (12):
[0028] NMC 110 maintains a catalog (database) of products for preview. NMC 110, in accumulating and compiling this information, also digitizes this information and provides it to a Network Operations Center (NOC) 120 in the form of digitized data files 122. It will be noted that data files 122, although referred to in terms of digitized audiovisual content, can also be streaming audio, streaming video, or other such information. Each product may have associated digital files containing information pertaining to the product. Alternatively, all the information may be compiled into one file. Following are examples of the types of files/information that may be catalogued and maintained:

Detail Description Paragraph (76):
[0092] One example of a multicasting technique is the Multicast File Transfer Protocol (MFTP) from Starburst.TM.. This protocol is described in great detail in the specification entitle "STARBURST MULTICAST FILE TRANSFER PROTOCOL (MFTP) SPECIFICATION," (filename: draft-miller-mftp-spec-03.txt; dated April, 1998) which can be viewed at the time of this writing at the following universal resource locator on the World Wide Web:

Detail Description Paragraph (90):
[0105] Receiver/decoder 135 is capable of receiving, processing, and providing voice, video, data, and other forms of information to various devices within commercial sales outlet 130. While the configuration of the communications network 125 (and in particular, transmitting station 121, receiving station 128, and receiver/decoder 135) will vary according to the technology used to distribute digital data files 122. For example, while transmitting station 121 and receiving station 128 are described in terms of a satellite network, one of skill in the art will recognize that these elements could support broadcast or duplex communications systems. These elements could therefore be satellite transmitters/receiver pairs, a multicast network, a UUCP

(Unix-to-Unix CoPy) network, or the like. Alternatively, these elements could be network interface cards, microwave transceivers, infrared transceivers, or the like. In this example, a satellite broadcasting system is employed. Transmitting station 121 and satellite 127 are implemented using commercially available satellite communication technology, and so are not described in detail herein.

Detail Description Paragraph (129):
[0144] Receiver/decoder 135 is preferably capable of receiving both digital and analog information. With regard to data reception and distribution, receiver/decoder 135 is connected to various network nodes in commercial sales outlet 130 via a network system 150. Network 150, while it may be directly connected to various other nodes in commercial sales outlet 130 is connected in FIG. 1B to multimedia server 160, as noted. For most of data files 122, once they are received by receiving station 128 at commercial sales outlet 130, they are passed to receiver/decoder 135, which in turn passes them on to multimedia server 160. Multimedia server 160 is connected via the network (e.g., an ether network using a TCP/IP protocol stack, and using FTP file transfers to distribute the promotional information) to various nodes in commercial sales outlet 130. These nodes include (but are not limited to) an in-line home video station 161, an in-line computer hardware and software interactive display 165, an in-store radio system 170, a wall-of-eyes 180 (which may be connected to either multimedia server 160, or to receiver/decoder 135 via a video switch 175, which is optional), listening posts 185, audio/video endcaps 190, audio/video endcaps in other departments 195, on-line services 200 and an entity LAN 210. Entity LAN 210 may be connected to an on-line internet commerce access system 220, a UNIX server 230 and/or a CBL server 240, among other such possible connections.

Detail Description Paragraph (309):
[0324] As noted, data sent via communications network 125 can be of several types. For example, receiver/decoder 135 may provide audiovisual training information to video cassette recorder (VCR) 140 via the direct video capabilities that communications network 125 may support (e.g., real-time analog, high-definition television (HDTV), or digital video information). Training VCR 140 allows such audiovisual information to be recorded for later playback, to allow the audiovisual information to be replayed for off-line training or during multiple training sessions.

L10: Entry 3 of 26 File: PGPB Aug 9, 2001

DOCUMENT-IDENTIFIER: US 20010013068 A1
TITLE: INTERLEAVED MULTIPLE MULTIMEDIA STREAM FOR SYNCHRONIZED TRANSMISSION OVER A COMPUTER NETWORK

Abstract Paragraph (1):
The production of an interleaved multimedia stream for servers and client computers coupled to each other by a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the internet. Interleaved multimedia streams can include compressed video frames for display in a video window, accompanying compressed audio frames and annotation frames. In one embodiment, a producer captures separate video/audio frames and generates an interleaved multimedia file. In another embodiment, the interleaved file include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. The interleaved file is then stored in the web server for subsequent retrieval by client computer(s) in a coordinated manner, so that the client computer(s) is able to synchronously display the video frames and displayable event(s) in a video window and event window(s), respectively. In some embodiments, the interleaved file includes packets with variable length fields, each of which are at least one numerical unit in length.

Application Filing Date (1):
19970325

Cross Reference to Related Applications Paragraph (1):
[0001] Pending U.S. patent application Ser. No. _____, entitled "Production of a Video Stream with Synchronized Annotations over a Computer Network", Attorney Docket Number VXT.sub.--703, assigned to VXtreme, Inc. and filed Mar. 14, 1997, is herein incorporated by reference in its entirety.

Summary of Invention Paragraph (6):
[0006] Pending patent application VXT.sub.--703 describes the production of separate video, audio and annotation streams for synchronous delivery from a stream server to a client computer. However, if the stream server is not available or not affordable to the end user at the client computer, then the client computer may only have access to web servers which are not designed to provide synchronous delivery capability of the separate video, audio and annotation streams.

Summary of Invention Paragraph (7):
[0007] In view of the foregoing, there are desired techniques for generating integrated multimedia content such as video and audio frames, for synchronous delivery from a web server client computer(s).

Summary of Invention Paragraph (10):
[0009] In one embodiment, a producer captures separate video/audio frames and generates an interleaved multimedia file. In another embodiment, the interleaved file include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream.

Summary of Invention Paragraph (11):
[0010] The interleaved file is then stored in the web server for subsequent retrieval by client computer(s) in a coordinated manner, so that the client computer(s) is able to synchronously display the video frames and displayable event(s) in a video window and event window(s), respectively. In some embodiments, the interleaved file includes packets with variable length fields, each of which are at least one numerical unit in

length.

Brief Description of Drawings Paragraph (6):
[0016] FIG. 4A is a flowchart illustrating the capture of a live video/audio stream from a video camera or from a previously stored video file.

Brief Description of Drawings Paragraph (8):
[0018] FIG. 5 shows an exemplary format for storing and delivering a compressed video stream.

Brief Description of Drawings Paragraph (12):
[0022] FIG. 9A illustrates one embodiment of the client computer which includes a web browser and a browser plug-in module for interfacing a web browser with a client module.

Brief Description of Drawings Paragraph (13):
[0023] FIG. 9B illustrates another embodiment of the client computer in which the browser plug-in module receives an interleaved stream from the web server and distributes the video/audio stream(s) to the video/audio decoder(s) and the annotation stream(s) to the annotation interpreter.

Detail Description Paragraph (13):
[0042] FIG. 2 is a block diagram showing an exemplary hardware environment for practicing the annotated video-on-demand (VOD) system of the present invention. The VOD system includes a production station 210, a stream server 220, at least one web server 230 and at least one client computer 240, each of which can be implemented using computer system 100 described above. Stream server 220 and web server 230 are coupled to client computer 240 via a computer network 290, e.g., the internet. Note that the disclosed hardware environment is exemplary. For example, production station 210 and stream server 220 can be implemented using two separate computer systems or using one computer system. In addition, if production station 210 and stream server 220 are implemented on separate computer systems as shown in FIG. 2, an optional direct connection (not shown) between production station 210 and stream server 220 can provide faster uploads of compressed video and annotation streams. In the following description, an audio stream optionally accompanies each video stream.

Detail Description Paragraph (14):
[0043] A producer 215, installed in production station 210, is a user-friendly tool for use by a designer 219 to create a synchronization script which includes annotation stream(s). The annotation stream(s) define the content(s) of a LiveScreen display 245 to be displayed on client computer 240 for a viewer 249. LiveScreen 245 display provides a graphical user interface (GUI) with multiple windows for synchronously displaying a video stream from stream server 220 and at least one displayable event stream. Examples of displayable events include textual/graphical information such as HTML-scripted web page(s) from web server 230.

Detail Description Paragraph (15):
[0044] In one embodiment, as shown in FIG. 3A, producer 215a includes a capture module 317a and an author module 318a. Production station 210 includes 16 MB of RAM and a 1 GB hard disk drive for capturing and storing an uncompressed or precompressed video stream. Sources for generating video streams include a video camera 312, a video cassette recorder (VCR) (not shown) or a previously digitized video file 314, e.g., a Video for Windows (.avi) file. For ease of installation and use by designer 219, producer 215a is implemented in a host environment which includes a window-based operating system such as Microsoft Windows 95 and a web browser such as Netscape's Navigator 3.x.

Detail Description Paragraph (16):
[0045] Referring also to the flowchart of FIG. 4A, in step 410 capture module 317a captures a live video/audio stream from video camera 312 or from the previously stored video file 314. If video camera 312 provides an analog video stream, e.g., an NTSC signal, a hardware capture card (not shown) provides the required conversion from the analog video stream to a digitized video stream. Because temporary storage of uncompressed video data is memory intensive, some form of pre-compression can be used to reduce the memory storage requirement of the input video stream during capture step 410 and prior to compression step 420.

Detail Description Paragraph (17):
[0046] In step 420, capture module 420 compresses the digitized video stream using a

suitable compression technique. In this embodiment, depending on the bandwidth capacity of the connection provided by network 290 between stream server 220 and client computer 240, e.g., a POTS modem, ISDN or Ethernet, a suitable frame resolution and frame rate combination is selected. FIG. 5 shows an exemplary format 500 for storing and delivering a compressed video stream.

Detail Description Paragraph (21):
[0050] Designer 219 may view frames from video stream 500 displayed in video window 720 for referencing and selecting appropriate time stamps to use in generating annotation streams. Within video window 720, VCR function buttons, e.g., a rewind button 724, a play button 726 and a fast forward button 728, are available for designer 219 to quickly traverse video stream 500. Since video window 720 is provided as a convenience for designer 219, if designer 219 has prior knowledge of the content of the video stream, designer 219 may proceed with the generation of the annotation streams without viewing video window 720.

Detail Description Paragraph (27):
[0056] In accordance with another aspect of the invention, LiveScreen display 600 also includes a table of contents (TOC) 630, enabling viewer 249 at client computer 240 to skip forward or backward to a point within the entire video/audio stream 500. TOC 630 include one or more content labels, each indexed to a corresponding time stamp in video stream 500, as defined by TOC time markers 791, 792, 793, 794 in LiveScreen display 600.

Detail Description Paragraph (28):
[0057] Referring now to FIG. 9A, in one embodiment of the present invention, client computer 240 includes a web browser 950 and a browser plug-in module 952a for interfacing web browser 950 with a main client module 960. Client module 960 includes an event registry 962, playout buffer(s) 966, video/audio decoder(s) 964, video/audio renderer(s) 965 and one or more dynamically loadable event applet(s), e.g., flipper applet 967, ticker applet 968 and VCR applet 969. In this embodiment, event registry 962 also functions as an annotation interpreter 963.

Detail Description Paragraph (29):
[0058] FIG. 10A is a flowchart illustrating the operation of client module 960. Assume that viewer 249 has not previously loaded client module 960 in client computer 240, but has already loaded a web browser 950, e.g., Netscape's Navigator (step 1010). Viewer 249 surfs the world-wide web (www) via the internet and locates a web site of interest to viewer 249. Typically, the web site of interest is hosted on web server 230. Accordingly, a target web page is downloaded from web server 230 and displayed on client computer 240.

Detail Description Paragraph (30):
[0059] The target web page includes a link to a customized LiveScreen display, e.g., display 600. If client module 960 has not been previously loaded, client module 960 is now loaded over web browser 950 for processing video/audio and annotation streams (step 1020). Depending on the implementation, a copy of client module 960 may be available from the web site of interest. Alternatively, the target web page may provide a HTML link to another web server which has an updated copy of client module 960.

Detail Description Paragraph (31):
[0060] Referring now to FIG. 10B, first, browser plug-in module 952a is installed over web browser 950 (step 1022). As discussed above, plug-in module 952a provides the interface between client module 960 and web browser 950. The target web page provides a HTML link to the format for LiveScreen display 600. The LiveScreen display format is retrieved and display 600 is installed on client computer 240 using web browser 950 (step 1024).

Detail Description Paragraph (33):
[0062] Referring back to FIG. 10A, encoded video/audio frames and associated annotation frames are streamed from stream server 220 to client computer 240 for synchronous display (step 1030). Streaming video and audio streams over a network is very efficient because streaming eliminates the need for a large buffer at client computer 240. In addition, streaming also provides flexibility, e.g., switching video sources midstream is possible without wasting network resources since streaming is based on a pseudo just-in-time (JIT) protocol and does not involve downloads of the entire video stream prior to display at client computer 240. If the underlying transmission protocol is HTTP, then video, audio and annotation packets are initially "pulled" by client computer 240 from server 220 using HTTP "get" packet(s).

Detail Description Paragraph (34):
[0063] Next, the encoded video/audio streams are decoded by decoder 964, i.e., decompressed using a suitable technique, and then displayed at client computer 240 by renderer 965 (step 1040).

Detail Description Paragraph (37):
[0066] Further, since the video and annotation streams are handled synchronously but separately by video decoder 964 and annotation interpreter 963, respectively, steps 1040 and 1050 can occur concurrently or consecutively. As discussed above, event registry 962 is capable of dynamic registration of event applets. Accordingly, annotation interpreter 963 is adaptable, and capable of automatic installation and linking of new event applet(s) to add new class(es) of displayable events for client computer 240.

Detail Description Paragraph (38):
[0067] After registering with event registry 962, flipper applet 967 provides the location of the flipper stream to broswer 950 which then begin receiving the flipper stream from stream server 220. Flipper annotation frames are provided by stream server 220 synchronously with the video/audio frames to client module 960 so that the annotations, i.e., displayable events can be synchronized for display at client computer 240 (step 1060). In this example, URL addresses, for synchronizing HTML page flips with video stream are provided to web broswer 950 thereby permitting client computer 240 to subsequently retrieve and display various textual and graphical elements changing at predetermined points corresponding to the timeline of the video stream. Note that HTML pages can be retrieved from one or more web server(s) 230.

Detail Description Paragraph (39):
[0068] Similarly, after registering with event registry 962, ticker (tape) applet 968 provides the location of the ticker stream to broswer 950 which then begins receiving the ticker stream from stream server 220. Ticker annotation frames are provided by stream server 220 synchronously with the video/audio frames so that the annotations, i.e., displayable ticker data can be synchronized for display at client computer 240 at predetermined points corresponding to the timeline of the video stream.

Detail Description Paragraph (42):
[0071] As shown in FIG. 11, a table of content 630 with content labels enables viewer 249 to skip forward or backward to predetermined locations in the video/audio stream. First, viewer 249 selects a content label of interest (step 1110). Examples of suitable content labels are section headings of the video stream. Next, client module 960 sends a message to stream server 220 with the time stamp of an I-frame from the video stream whose location is close to selected content label (step 1120). In this embodiment, an I-frame is a video frame which includes data for a complete video frame. Although computationally more intensive, it is also possible to select a P-frame and then reconstructed a complete video starting from a neighboring I-frame close to the selected P-frame.

Detail Description Paragraph (44):
[0073] Referring now to FIGS. 3B and 9B, in another embodiment, instead of streaming three separate video, audio and annotation streams from stream server 220 to client computer 240, an interleaved video/audio/annotation file is produced by producer 215b, stored in web server 230, and subsequently provided to client module 960 on demand via web browser 950. Note that an interleaved file can include any two or more frame types, e.g., video and audio frames, video and annotation frames, or audio and annotation frames.

Detail Description Paragraph (45):
[0074] Advantages of this embodiment include simplified synchronous delivery of video, audio and annotation frames to client computer 240. Simplicity is accomplished by eliminating the need for stream server 220, whose primary function is to manage the transmission of several separate video, audio and annotation streams from stream server 220 to client computer 240. In this embodiment, since all the video, audio and annotation frames are combined into a single interleaved stream and are pre-sorted by timestamp values, the interleaved stream can now be stored in web server 230 and delivered in the form of HTTP data.

Detail Description Paragraph (52):
[0081] In accordance with another aspect of this embodiment, the data packets 1320, 1330, . . . 1390 for streaming video and audio frames include a variable packet length

field 1324 as shown in FIGS. 13A and 13B. Referring to FIGS. 14A, 14B, and 14C, three exemplary formats 1324a, 1324b, and 1324c of the variable packet length field 1324 are shown. In this implementation, the length of the variable packet length field is in multiples of number units. For example, formats 1324a, 1324b and 1324c can be one numerical unit in length, three numerical units in length and seven numerical units in length, respectively. As is known to one skilled in the art, regardless of the size of the packet length field, the packet length can be represented by a number of different methods, such as simple binary, one's complement, BCD and floating point.

CLAIMS:

1. In a computer having a processor and memory, said computer useful in association with a web server coupled to a client computer via a network, a method for producing an interleaved multimedia file from a video file and an audio file, the method comprising the steps of: if a video frame buffer is empty, then retrieving a first video frame from the video file, said first video frame including a video timestamp; if an audio frame buffer is empty, then retrieving a first audio frame from the audio file, said first audio frame including an audio timestamp; and if the video timestamp is less than or equal to the audio timestamp, then writing the first video frame to a first packet of the interleaved file; and retrieving a second video frame from the video file; else if the audio timestamp is less than or equal to the video timestamp, then writing the first audio frame to a second packet of the interleaved file; and retrieving a second audio frame from the audio file.

L10: Entry 4 of 26 File: USPT Apr 22, 2003

DOCUMENT-IDENTIFIER: US 6553404 B2
TITLE: Digital system

Abstract Text (1):
A digital department system is disclosed. The digital department system includes a network management center, a network operating center that is coupled to the network management center, a multimedia server, a multicasting transmission medium coupling the network operating center and the multimedia server, a listening post coupled to the multimedia server by the network, and one or more audio/video display capable of displaying video and capable of playing audio, the audio video display coupled to the multimedia server by the network. The audio and video content are stored in digitized files on the multimedia server for distribution throughout the site via the network.

Application Filing Date (1):
19980807

Brief Summary Text (13):
In one embodiment of the present invention, a digital department system is provided. The digital department system of the present invention includes a network management center, a network operating center that is coupled to the network management center, a multimedia server, a multicasting transmission medium coupling the network operating center and the multimedia server, a listening post coupled to the multimedia server by the network, and one or more audio/video display capable of displaying video and capable of playing audio, the audio video display coupled to the multimedia server by the network. The audio and video content are stored in digitized files on the multimedia server for distribution throughout the site via the network.

Detailed Description Text (12):
NMC 110 maintains a catalog (database) of products for preview. NMC 110, in accumulating and compiling this information, also digitizes this information and provides it to a Network Operations Center (NOC) 120 in the form of digitized data files 122. It will be noted that data files 122, although referred to in terms of digitized audiovisual content, can also be streaming audio, streaming video, or other such information. Each product may have associated digital files containing information pertaining to the product. Alternatively, all the information may be compiled into one file. Following are examples of the types of files/information that may be catalogued and maintained: Video clips (music video, movie clip, product demonstration, and the like) Liner notes Date for broadcast Audio clips Song titles Region for broadcast Graphics Album/artist info Date to delete

Detailed Description Text (33):
One example of a multicasting technique is the Multicast File Transfer Protocol (MFTP) from Starburst.TM.. This protocol is described in great detail in the specification entitle "STARBURST MULTICAST FILE TRANSFER PROTOCOL (MFTP) SPECIFICATION," (filename: draft-miller-mftp-spec-03.txt; dated April, 1998) which can be viewed at the time of this writing at the following universal resource locator on the World Wide Web:

Detailed Description Text (46):
Receiver/decoder 135 is capable of receiving, processing, and providing voice, video, data, and other forms of information to various devices within commercial sales outlet 130. While the configuration of the communications network 125 (and in particular, transmitting station 126, receiving station 128, and receiver/decoder 135) will vary according to the technology used to distribute digital data files 122. For example, while transmitting station 126 and receiving station 128 are described in terms of a satellite network, one of skill in the art will recognize that these elements could support broadcast or duplex communications systems. These elements could therefore be satellite transmitters/receiver pairs, a multicast network, a UUCP (Unix-to-Unix CoPy)

network, or the like. Alternatively, these elements could be network interface cards, microwave transceivers, infrared transceivers, or the like. In this example, a satellite broadcasting system is employed. Transmitting station 126 and satellite 127 are implemented using commercially available satellite communication technology, and so are not described in detail herein.

Detailed Description Text (65):
Receiver/decoder 135 is preferably capable of receiving both digital and analog information. With regard to data reception and distribution, receiver/decoder 135 is connected to various network nodes in commercial sales outlet 130 via a network system 150. Network 150, while it may be directly connected to various other nodes in commercial sales outlet 130 is connected in FIG. 1B to multimedia server 160, as noted. For most of data files 122, once they are received by receiving station 128 at commercial sales outlet 130, they are passed to receiver/decoder 135, which in turn passes them on to multimedia server 160. Multimedia server 160 is connected via the network (e.g., an ether network using a TCP/IP protocol stack, and using FTP file transfers to distribute the promotional information) to various nodes in commercial sales outlet 130. These nodes include (but are not limited to) an in-line home video station 161, an in-line computer hardware and software interactive display 165, an in-store radio system 170, a wall-of-eyes 180 (which may be connected to either multimedia server 160, or to receiver/decoder 135 via a video switch 175, which is optional), listening posts 185, audio/video endcaps 190, audio/video endcaps in other departments 195, on-line services 200 and an entity LAN 210. Entity LAN 210 may be connected to an on-line internet commerce access system 220, a UNIX server 230 and/or a CBL server 240, among other such possible connections.

Detailed Description Text (149):
As noted, data sent via communications network 125 can be of several types. For example, receiver/decoder 135 may provide audiovisual training information to video cassette recorder (VCR) 140 via the direct video capabilities that communications network 125 may support (e.g., real-time analog, high-definition television (HDTV), or digital video information). Training VCR 140 allows such audiovisual information to be recorded for later playback, to allow the audiovisual information to be replayed for off-line training or during multiple training sessions.

L10: Entry 6 of 26 File: USPT Sep 10, 2002

DOCUMENT-IDENTIFIER: US 6449653 B2
**** See image for Certificate of Correction ****
TITLE: Interleaved multiple multimedia stream for synchronized transmission over a computer network

Abstract Text (1):
The production of an interleaved multimedia stream for servers and client computers coupled to each other by a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the internet. Interleaved multimedia streams can include compressed video frames for display in a video window, accompanying compressed audio frames and annotation frames. In one embodiment, a producer captures separate video/audio frames and generates an interleaved multimedia file. In another embodiment, the interleaved file include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. The interleaved file is then stored in the web server for subsequent retrieval by client computer(s) in a coordinated manner, so that the client computer(s) is able to synchronously display the video frames and displayable event(s) in a video window and event window(s), respectively. In some embodiments, the interleaved file includes packets with variable length fields, each of which are at least one numerical unit in length.

Application Filing Date (1):
19970325

Parent Case Text (2):
Pending U.S. patent application Ser. No. 08/818,804, entitled "Production of a Video Stream with Synchronized Annotations over a Computer Network", Attorney Docket Number VXT.sub.-- 703, assigned to VXtreme, Inc. and filed Mar. 14, 1997, is herein incorporated by reference in its entirety. Patent application Ser. No. 08/818,804 issued as U.S. Pat. No. 6,006,241 on Dec. 21, 1999, assignee Microsoft Corporation of Redmond, Wash.

Brief Summary Text (6):
Pending patent application VXT.sub.-- 703 describes the production of separate video, audio and annotation streams for synchronous delivery from a stream server to a client computer. However, if the stream server is not available or not affordable to the end user at the client computer, then the client computer may only have access to web servers which are not designed to provide synchronous delivery capability of the separate video, audio and annotation streams.

Brief Summary Text (7):
In view of the foregoing, there are desired techniques for generating integrated multimedia content such as video and audio frames, for synchronous delivery from a web server client computer(s).

Brief Summary Text (10):
In one embodiment, a producer captures separate video/audio frames and generates an interleaved multimedia file. In another embodiment, the interleaved file include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream.

Brief Summary Text (11):
The interleaved file is then stored in the web server for subsequent retrieval by client computer(s) in a coordinated manner, so that the client computer(s) is able to

synchronously display the video frames and displayable event(s) in a video window and event window(s), respectively. In some embodiments, the interleaved file includes packets with variable length fields, each of which are at least one numerical unit in length.

Drawing Description Text (6):
FIG. 4A is a flowchart illustrating the capture of a live video/audio stream from a video camera or from a previously stored video file.

Drawing Description Text (8):
FIG. 5 shows an exemplary format for storing and delivering a compressed video stream.

Drawing Description Text (12):
FIG. 9A illustrates one embodiment of the client computer which includes a web browser and a browser plug-in module for interfacing a web browser with a client module.

Drawing Description Text (13):
FIG. 9B illustrates another embodiment of the client computer in which the browser plug-in module receives an interleaved stream from the web server and distributes the video/audio stream(s) to the video/audio decoder(s) and the annotation stream(s) to the annotation interpreter.

Detailed Description Text (13):
FIG. 2 is a block diagram showing an exemplary hardware environment for practicing the annotated video-on-demand (VOD) system of the present invention. The VOD system includes a production station 210, a stream server 220, at least one web server 230 and at least one client computer 240, each of which can be implemented using computer system 100 described above. Stream server 220 and web server 230 are coupled to client computer 240 via a computer network 290, e.g., the internet. Note that the disclosed hardware environment is exemplary. For example, production station 210 and stream server 220 can be implemented using two separate computer systems or using one computer system. In addition, if production station 210 and stream server 220 are implemented on separate computer systems as shown in FIG. 2, an optional direct connection (not shown) between production station 210 and stream server 220 can provide faster uploads of compressed video and annotation streams. In the following description, an audio stream optionally accompanies each video stream.

Detailed Description Text (14):
A producer 215, installed in production station 210, is a user-friendly tool for use by a designer 219 to create a synchronization script which includes annotation stream(s). The annotation stream(s) define the content(s) of a LiveScreen display 245 to be displayed on client computer 240 for a viewer. LiveScreen display 245 provides a graphical user interface (GUI) with multiple windows for synchronously displaying a video stream from stream server 220 and at least one displayable event stream. Examples of displayable events include textual/graphical information such as HTML-scripted web page(s) from web server 230.

Detailed Description Text (15):
In one embodiment, as shown in FIG. 3A, producer 215a includes a capture module 317a and an author module 318a. Production station 210 includes 16 MB of RAM and a 1 GB hard disk drive for capturing and storing an uncompressed or precompressed video stream. Sources for generating video streams include a video camera 312, a video cassette recorder (VCR) (not shown) or a previously digitized video file 314, e.g., a Video for Windows (.avi) file. For ease of installation and use by designer 219, producer 215a is implemented in a host environment which includes a window-based operating system such as Microsoft Windows 95 and a web browser such as Netscape's Navigator 3.x.

Detailed Description Text (16):
Referring also to the flowchart of FIG. 4A, in step 410 capture module 317a captures a live video/audio stream from video camera 312 or from the previously stored video file 314. If video camera 312 provides an analog video stream, e.g., an NTSC signal, a hardware capture card (not shown) provides the required conversion from the analog video stream to a digitized video stream. Because temporary storage of uncompressed video data is memory intensive, some form of pre-compression can be used to reduce the memory storage requirement of the input video stream during capture step 410 and prior to compression step 420.

Detailed Description Text (17):
In step 420, capture module 317a compresses the digitized video stream using a suitable

compression technique. In this embodiment, depending on the bandwidth capacity of the connection provided by network 290 between stream server 220 and client computer 240, e.g., a POTS modem, ISDN or Ethernet, a suitable frame resolution and frame rate combination is selected. FIG. 5 shows an exemplary format 500 for storing and delivering a compressed video stream.

Detailed Description Text (21):
Designer 219 may view frames from video stream 500 displayed in video window 720 for referencing and selecting appropriate time stamps to use in generating annotation streams. Within video window 720, VCR function buttons, e.g., a rewind button 724, a play button 726 and a fast forward button 728, are available for designer 219 to quickly traverse video stream 500. Since video window 720 is provided as a convenience for designer 219, if designer 219 has prior knowledge of the content of the video stream, designer 219 may proceed with the generation of the annotation streams without viewing video window 720.

Detailed Description Text (27):
In accordance with another aspect of the invention, LiveScreen display 600 also includes a table of contents (TOC) 630, enabling viewer 249 at client computer 240 to skip forward or backward to a point within the entire video/audio stream 500. TOC 630 include one or more content labels, each indexed to a corresponding time stamp in video stream 500, as defined by TOC time markers 791, 792, 793, 794 in LiveScreen display 600.

Detailed Description Text (28):
Referring now to FIG. 9A, in one embodiment of the present invention, client computer 240 includes a web browser 950 and a browser plug-in module 952a for interfacing web browser 950 with a main client module 960. Client module 960 includes an event registry 962, playout buffer(s) 966, video/audio decoder(s) 964, video/audio renderer(s) 965 and one or more dynamically loadable event applet(s), e.g., flipper applet 967, ticker applet 968 and VCR applet 969. In this embodiment, event registry 962 also functions as an annotation interpreter 963.

Detailed Description Text (29):
FIG. 10A is a flowchart illustrating the operation of client module 960. Assume that viewer has not previously loaded client module 960 in client computer 240, but has already loaded a web browser 950, e.g., Netscape's Navigator (step 1010). Viewer surfs the world-wide web (www) via the internet and locates a web site of interest. Typically, the web site of interest is hosted on web server 230. Accordingly, a target web page is downloaded from web server 230 and displayed on client computer 240.

Detailed Description Text (30):
The target web page includes a link to a customized LiveScreen display, e.g., display 600. If client module 960 has not been previously loaded, client module 960 is now loaded over web browser 950 for processing video/audio and annotation streams (step 1020). Depending on the implementation, a copy of client module 960 may be available from the web site of interest. Alternatively, the target web page may provide a HTML link to another web server which has an updated copy of client module 960.

Detailed Description Text (31):
Referring now to FIG. 10B, first, browser plug-in module 952a is installed over web browser 950 (step 1022). As discussed above, plug-in module 952a provides the interface between client module 960 and web browser 950. The target web page provides a HTML link to the format for LiveScreen display 600. The LiveScreen display format is retrieved and display 600 is installed on client computer 240 using web browser 950 (step 1024).

Detailed Description Text (33):
Referring back to FIG. 10A, encoded video/audio frames and associated annotation frames are streamed from stream server 220 to client computer 240 for synchronous display (step 1030). Streaming video and audio streams over a network is very efficient because streaming eliminates the need for a large buffer at client computer 240. In addition, streaming also provides flexibility, e.g., switching video sources midstream is possible without wasting network resources since streaming is based on a pseudo just-in-time (JIT) protocol and does not involve downloads of the entire video stream prior to display at client computer 240. If the underlying transmission protocol is HTTP, then video, audio and annotation packets are initially "pulled" by client computer 240 from server 220 using HTTP "get" packet(s).

Detailed Description Text (34):

Next, the encoded video/audio streams are decoded by decoder 964, i.e., decompressed using a suitable technique, and then displayed at client computer 240 by renderer 965 (step 1040).

Detailed Description Text (37):
Further, since the video and annotation streams are handled synchronously but separately by video decoder 964 and annotation interpreter 963, respectively, steps 1040 and 1050 can occur concurrently or consecutively. As discussed above, event registry 962 is capable of dynamic registration of event applets. Accordingly, annotation interpreter 963 is adaptable, and capable of automatic installation and linking of new event applet(s) to add new class(es) of displayable events for client computer 240.

Detailed Description Text (38):
After registering with event registry 962, flipper applet 967 provides the location of the flipper stream to broswer 950 which then begin receiving the flipper stream from stream server 220. Flipper annotation frames are provided by stream server 220 synchronously with the video/audio frames to client module 960 so that the annotations, i.e., displayable events can be synchronized for display at client computer 240 (step 1060). In this example, URL addresses, for synchronizing HTML page flips with video stream are provided to web browser 950 thereby permitting client computer 240 to subsequently retrieve and display various textual and graphical elements changing at predetermined points corresponding to the timeline of the video stream. Note that HTML pages can be retrieved from one or more web server(s) 230.

Detailed Description Text (39):
Similarly, after registering with event registry 962, ticker (tape) applet 968 provides the location of the ticker stream to broswer 950 which then begins receiving the ticker stream from stream server 220. Ticker annotation frames are provided by stream server 220 synchronously with the video/audio frames so that the annotations, i.e., displayable ticker data can be synchronized for display at client computer 240 at predetermined points corresponding to the timeline of the video stream.

Detailed Description Text (42):
As shown in FIG. 11, a table of content 630 with content labels enables a viewer to skip forward or backward to predetermined locations in the video/audio stream. First, viewer selects a content label of interest (step 1110). Examples of suitable content labels are section headings of the video stream. Next, client module 960 sends a message to stream server 220 with the time stamp of an I-frame from the video stream whose location is close to selected content label (step 1120). In this embodiment, an I-frame is a video frame which includes data for a complete video frame. Although computationally more intensive, it is also possible to select a P-frame and then reconstructed a complete video starting from a neighboring I-frame close to the selected P-frame.

Detailed Description Text (44):
Referring now to FIGS. 3B and 9B, in another embodiment, instead of streaming three separate video, audio and annotation streams from stream server 220 to client computer 240, an interleaved video/audio/annotation file is produced by producer 215b, stored in web server 230, and subsequently provided to client module 960 on demand via web browser 950. Note that an interleaved file can include any two or more frame types, e.g., video and audio frames, video and annotation frames, or audio and annotation frames.

Detailed Description Text (45):
Advantages of this embodiment include simplified synchronous delivery of video, audio and annotation frames to client computer 240. Simplicity is accomplished by eliminating the need for stream server 220, whose primary function is to manage the transmission of several separate video, audio and annotation streams from stream server 220 to client computer 240. In this embodiment, since all the video, audio and annotation frames are combined into a single interleaved stream and are pre-sorted by timestamp values, the interleaved stream can now be stored in web server 230 and delivered in the form of HTTP data.

Detailed Description Text (52):
In accordance with another aspect of this embodiment, the data packets 1320, 1330, . . . 1390 for streaming video and audio frames include a variable packet length field 1324 as shown in FIGS. 13A and 13B. Referring to FIGS. 14A, 14B, and 14C, three exemplary formats 1324a, 1324b, and 1324c of the variable packet length field 1324 are shown. In

this implementation, the length of the variable packet length field is in multiples of number units. For example, formats 1324a, 1324b and 1324c can be one numerical unit in length, three numerical units in length and seven numerical units in length, respectively. As is known to one skilled in the art, regardless of the size of the packet length field, the packet length can be represented by a number of different methods, such as simple binary, one's complement, BCD and floating point.

CLAIMS:

1. In a computer having a processor and memory, said computer useful in association with a web server coupled to a client computer via a network, a method for producing an interleaved multimedia file from a video file and an audio file, the method comprising: retrieving a first video frame from the video file, said first video frame including a video timestamp, in response to determining a video frame buffer is empty; retrieving a first audio frame from the audio file, said first audio frame including a audio timestamp, in response to determining an audio frame buffer is empty; writing the first video frame to a first packet of the interleaved file in response to determining that the video timestamp is less than or equal to the audio timestamp, retrieving a second video frame from the video file in response to determining that the video timestamp is less than or equal to the audio timestamp, writing the first audio frame to a second packet of the interleaved file in response to determining that the audio timestamp is less than or equal to the video timestamp, and retrieving a second audio frame from the audio file in response to determining that the audio timestamp is less than or equal to the video timestamp; writing a size of a variable packet length field of the first packet of the interleaved multimedia file to a length field of the variable packet length field of the first packet of the interleaved multimedia file; and writing at least one null number into a null field of the variable packet length field of the first packet of the interleaved multimedia file, a number of null numbers written into the null field being selected as a function of a size of the first video frame.

3. In a computer having a processor and memory, said computer useful in association with a web server coupled to a client computer via a network, a method for producing an interleaved multimedia file from a video file and an audio file, the method comprising: retrieving a first video frame from the video file, said first video frame including a video timestamp, upon determining that a video frame buffer is empty; retrieving a first audio frame from the audio file, said first audio frame including an audio timestamp, upon determining that an audio frame buffer is empty; and writing the first video frame to a first packet of the interleaved file upon determining that the video timestamp is less than or equal to the audio timestamp, retrieving a second video frame from the video file upon determining that the video timestamp is less than or equal to the audio timestamp, writing the first audio frame to a second packet of the interleaved file upon determining that the audio timestamp is less than or equal to the video timestamp, and retrieving a second audio frame from the audio file upon determining that the audio timestamp is less than or equal to the video timestamp, wherein said first and second packet each have a variable packet length field having a size, wherein the size of the variable packet length field is at least one numerical unit, and writing the first video frame to the first packet includes writing the size into a length of the variable packet length field of the first packet, writing a null number into a null field of the variable packet length field of the first packet upon determining the size of the first video frame is between one numerical unit and two numerical units, and writing three null numbers into the null field of the variable packet length field of the first packet upon determining the size of the first video frame is greater than two numerical units.

11. In a computer having a processor and memory, said computer useful in association with a web server coupled to a client computer via a network, a method for producing an interleaved multimedia file from a video file and an audio file, the method comprising: retrieving a first video frame from the video file, said first video frame including a video timestamp, upon determining that a video frame buffer is empty; retrieving a first audio frame from the audio file, said first audio frame including an audio timestamp, upon determining that an audio frame buffer is empty; and writing the first video frame to a first packet of the interleaved file upon determining that the video timestamp is less than or equal to the audio timestamp; retrieving a second video frame from the video file upon determining that the video timestamp is less than or equal to the audio timestamp; writing the first audio frame to a second packet of the interleaved file upon determining that the audio timestamp is less than or equal to the video timestamp; and retrieving a second audio frame from the audio file upon determining that the audio timestamp is less than or equal to the video timestamp, wherein said first and second packet each have a variable packet length field having a

size, wherein the size of the variable packet length field is at least one numerical unit, and writing the first video frame to the first packet includes writing the size into a length field of the variable packet length field of the first packet, and writing a number into a field of the variable packet length field, wherein the number corresponds to the size of the video frame.

13. In a computer having a processor and a memory, the computer useful in association with a web server coupled to a client computer via a network, a method for producing an interleaved multimedia file from a video file and an audio file, the method comprising: retrieving a first video frame from the video file in response to determining that a video frame buffer is empty, the first video frame having a video timestamp; retrieving a first audio frame from the audio file in response to determining that an audio frame buffer is empty, the first audio frame having an audio timestamp; writing the first video frame to a first packet of the interleaved multimedia file in response to determining that the video timestamp is not greater than the audio timestamp; retrieving a second video frame from the video file in response to determining that the video timestamp is not greater than the audio timestamp; writing the first audio frame to a second packet of the interleaved multimedia file in response to determining that the audio timestamp is not greater than the video timestamp; retrieving a second audio frame from the audio file in response to determining that the audio timestamp is not greater than the video timestamp; and representing a length of a variable packet length field of a packet of the interleaved multimedia rule such that the length can be determined from one or more null numbers included within the variable packet length field.

14. In a computer having a processor and a memory, the computer useful in association with a web server coupled to a client computer via a network, a method for producing an interleaved multimedia file from a video file and an audio file, the method comprising: retrieving a first video frame from a video file in response to determining that a video frame buffer is empty, the first video frame having a video timestamp; retrieving a first audio frame from an audio file in response to determining that an audio frame buffer is empty, the first audio frame having an audio timestamp; writing the first video frame to a first packet of the interleaved multimedia file in response to determining that the video timestamp is not greater than the audio timestamp; retrieving a second video frame from the video file in response to determining that the video timestamp is not greater than the audio timestamp; writing the first audio frame to a second packet of the interleaved multimedia file in response to determining that the audio timestamp is not greater than the video timestamp; retrieving a second audio frame from the audio file in response to determining that the audio timestamp is not greater than the video timestamp; writing a size of a variable packet length field of the first packet of the interleaved multimedia file to a length field of the variable packet length field of the first packet of the interleaved multimedia file; and writing at least one reserved value to the variable packet length field of the first packet of the interleaved multimedia file, a number of reserved values written being selected as a function of a size of the first video frame.

WEST

Generate Collection

L10: Entry 19 of 26 File: USPT Dec 21, 1999

DOCUMENT-IDENTIFIER: US 6006241 A
TITLE: Production of a video stream with synchronized annotations over a computer network

Abstract Text (1):
The production of synchronization scripts and associated annotated multimedia streams for servers and client computers coupled to each other by a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the internet. Annotated multimedia streams can include a compressed video stream for display in a video window, an accompanying compressed audio stream and annotations. Synchronization scripts include annotation streams for synchronizing the display of video streams with annotations, e.g., displayable events, such textual/graphical data in the form of HTML pages with Java applets to be displayed in one or more event windows. The producer includes a capture module and an author module for capturing video streams and generating annotation streams, respectively. The capture module compresses the video stream using a suitable compression format. Annotation streams include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream. Embedded displayable data include ticker tape data embedded within the annotation stream. Examples of event locators to displayable events include URL addresses pointing to HTML web pages. The video/audio streams and annotation streams are stored in stream server(s) for subsequent retrieval by client computer(s) in a coordinated manner, so that the client computer(s) is able to synchronously display the video frames and displayable event(s) in a video window and event window(s), respectively. In one implementation, annotation streams include a flipper stream for locating HTML pages and a ticker stream which include ticker (tape) data.

Application Filing Date (1):
19970314

Parent Case Text (1):
This application is related to co-pending U.S. application Ser. No. 08/818,805, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Motion Detection in Video Compression", non-final action mailed May 12, 1999 U.S. application Ser. No. 08/819/507, filed on Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method", final rejection mailed Jun. 3, 1999 U.S. application Ser. No. 08/818,804, filed on Mar. 14, 1997, entitled "Production of a Video Stream with Synchronized Annotations over a Computer Network", case allowed Jun. 7, 1999 U.S. application Ser. No. 08/819,586, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Control Functions in a Streamed Video Display System", Response to non-final Enter May 6, 1999 U.S. application Ser. No. 08/818,769, filed on Mar. 14, 1997, entitled "Method and Apparatus for Automatically Detecting Protocols in a Computer Network", Response to non-final entered U.S. application Ser. No. 08/818,127, filed on Mar. 14, 1997, entitled "Dynamic Bandwidth Selection for Efficient Transmission of Multimedia Streams in a Computer Network", Final rejection mailed Apr. 27, 1999 U.S. application Ser. No. 08/819,585, filed on Mar. 14, 1997, entitled "Streaming and Display of a Video Stream with Synchronized Annotations over a Computer Network", case available for examination U.S. application Ser. No. 08/818,664, filed on Mar. 14, 1997, entitled "Selective Retransmission for Efficient and Reliable Streaming of Multimedia Packets in a Computer Network", Allowed Jun. 1, 1999 U.S. application Ser. No. 08/819,579, filed on Mar. 14, 1997, entitled "Method and Apparatus for Table-Based Compression with Embedded Coding", Incomplete application--mailed Jun. 16, 1999 U.S. application Ser. No. 08/819,587, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Motion Estimation in Video Compression", Appeal Brief filed May 5, 1999 U.S. application Ser.

No. 08/818,826, filed on Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method", all filed concurrently herewith, patented file May 1, 1999 U.S. application Ser. No. 08/822,156, filed on Mar. 17, 1997, entitled "Method and Apparatus for Communication Media Commands and Data Using the HTTP Protocol", Response to non-final office Action Mar. 25, 1999 provisional U.S. Application Ser. No. 60/036,662, filed on Jan. 30, 1997, entitled "Methods and Apparatus for Autodetecting Protocols in a Computer Network" application Expired Mar. 20, 1999 U.S. application Ser. No. 08/625,650 filed on Mar. 29, 1996, entitled "Table-Based Low-Level Image Classification System", Response to non-final office Action entered Jun. 9, 1999 U.S. application Ser. No. 08/714,447, filed on Sep. 16, 1996, entitled "Multimedia Compression System with Additive Temporal Layers", and is a continuation-in-part of U.S. application Ser. No. 08/623,299, non-final Action mailed Feb. 19, 1999 filed on Mar. 28, 1996, entitled "Table-Based Compression with Embedded Coding", which are all incorporated by reference in their entirety for all purposes incomplete application--mailed Jun. 10, 1999.

Brief Summary Text (6):
Existing conventional internet applications, such as electronic mailers and web browser, are capable of transferring and presenting textual and graphical information. However, none of these individual internet applications effectively provide synchronous delivery of a combination of diverse multimedia streams in a coherent and integrated manner. This is because executing several independent and unrelated applications to present the diverse combination of multimedia streams on a client computer can result in a hodgepodge of poor quality, incompatible and/or incoherent presentations.

Brief Summary Text (7):
In view of the foregoing, there are desired improved techniques for reliably providing a multimedia stream such as a video and audio stream, together with annotations such as textual and graphical information in an integrated seamless package to client computer(s), while efficiently utilizing the network resources and consuming minimal computational cycles on the client computer(s).

Brief Summary Text (9):
The present invention provides synchronization scripts and associated annotated multimedia streams for servers and client computers coupled to each other by a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the internet. Annotated multimedia streams can include a compressed video stream for display in a video window, an accompanying compressed audio stream and annotations. Synchronization scripts include annotation streams for synchronizing the display of video streams with annotations, e.g., displayable events, such textual/graphical data in the form of HTML pages with Java applets to be displayed in one or more event windows.

Brief Summary Text (10):
In one embodiment, a producer includes a capture module and an author module for capturing video streams and generating annotation streams, respectively. The video and annotation streams are then stored in stream server(s) to be provided to one or more client computer(s) upon request.

Brief Summary Text (11):
The capture module compresses the video stream using a compression format based on a standard H263, generating, for example, a QCIF resolution (176.times.144) video frames at 10-20 frames per second (fps) which can be encoded and transmitted over a 20 Kbps connection. Alternatively, using the scalable vector quantization (SVQ) compression algorithm of the present invention, dynamically scalable data transmission rates from 10 Kbps to several Mbps can support scalable resolutions of 160.times.120 to 640.times.480 and frames rates ranging from 1 fps to 30 fps. Other compression techniques can also be used with the present invention.

Brief Summary Text (12):
In this embodiment, annotation streams include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream. Examples of embedded displayable data include ticker tape data embedded within the annotation stream. Examples of event locators to displayable events include URL addresses pointing to HTML web pages. Note that an event time marker need not be identical to a corresponding video time stamp. The client computer is capable of switching to a new displayable event together with a video frame or in between two

video frames.

Drawing Description Text (6):
FIG. 4A is a flowchart illustrating the capture of a live video/audio stream from a video camera or from a previously stored video file.

Drawing Description Text (8):
FIG. 5 shows an exemplary format for storing and delivering a compressed video stream.

Drawing Description Text (12):
FIG. 9 illustrates one embodiment of the client computer which includes a web browser and a browser plug-in module for interfacing a web browser with a client module.

Detailed Description Text (13):
FIG. 2 is a block diagram showing an exemplary hardware environment for practicing the annotated video-on-demand (VOD) system of the present invention. The VOD system includes a production station 210, a stream server 220, at least one web server 230 and at least one client computer 240, each of which can be implemented using computer system 100 described above. Stream server 220 and web server 230 are coupled to client computer 240 via a computer network 290, e.g., the internet. Note that the disclosed hardware environment is exemplary. For example, production station 210 and stream server 220 can be implemented using two separate computer systems or using one computer system. In addition, if production station 210 and stream server 220 are implemented on separate computer systems as shown in FIG. 2, an optional direct connection (not shown) between production station 210 and stream server 220 can provide faster uploads of compressed video and annotation streams. In the following description, an audio stream optionally accompanies each video stream.

Detailed Description Text (14):
A producer 215, installed in production station 210, is a user-friendly tool for use by a designer 219 to create a synchronization script which includes annotation stream(s). The annotation stream(s) define the content(s) of a LiveScreen display 245 to be displayed on client computer 240 for a viewer 249. LiveScreen 245 display provides a graphical user interface (GUI) with multiple windows for synchronously displaying a video stream from stream server 220 and at least one displayable event stream. Examples of displayable events include textual/graphical information such as HTML-scripted web page(s) from web server 230.

Detailed Description Text (15):
In one embodiment, as shown in FIG. 3, producer 215 includes a capture module 317 and an author module 318. Production station 210 includes 16 MB of RAM and a 1 GB hard disk drive for capturing and storing an uncompressed or precompressed video stream. Sources for generating video streams include a video camera 312, a video cassette recorder (VCR) (not shown) or a previously digitized video file 314, e.g., a Video for Windows (.avi) file. For ease of installation and use by designer 219, producer 215 is implemented in a host environment which includes a window-based operating system such as Microsoft Windows 95 and a web browser such as Netscape's Navigator 3.x. (Appendix A is a detailed user manual for one implementation of producer 215).

Detailed Description Text (16):
Referring also to the flowchart of FIG. 4A, in step 410 capture module 317 captures a live video/audio stream from video camera 312 or from the previously stored video file 314. If video camera 312 provides an analog video stream, e.g., an NTSC signal, a hardware capture card (not shown) provides the required conversion from the analog video stream to a digitized video stream. Because temporary storage of uncompressed video data is memory intensive, some form of pre-compression can be used to reduce the memory storage requirement of the input video stream during capture step 410 and prior to compression step 420.

Detailed Description Text (17):
In step 420, capture module 420 compresses the digitized video stream using a suitable compression technique. In this embodiment, depending on the bandwidth capacity of the connection provided by network 290 between stream server 220 and client computer 240, e.g., a POTS modem, ISDN or Ethernet, a suitable frame resolution and frame rate combination is selected. A compression algorithm based on the H263 standard (see co-pending applications VXT 702 and 718) is used for compressing lower bandwidth video streams, e.g., at less than 56 kbps. Alternatively, a Vxpress format (see co-pending application VXT 712) is used for compressing higher bandwidth video streams. FIG. 5 shows an exemplary format 500 for storing and delivering a compressed video stream.

Detailed Description Text (21):
Designer 219 may view frames from video stream 500 displayed in video window 720 for referencing and selecting appropriate time stamps to use in generating annotation streams. Within video window 720, VCR function buttons, e.g., a rewind button 724, a play button 726 and a fast forward button 728, are available for designer 219 to quickly traverse video stream 500. Since video window 720 is provided as a convenience for designer 219, if designer 219 has prior knowledge of the content of the video stream, designer 219 may proceed with the generation of the annotation streams without viewing video window 720.

Detailed Description Text (27):
In accordance with another aspect of the invention, LiveScreen display 600 also includes a table of contents (TOC) 630, enabling viewer 249 at client computer 240 to skip forward or backward to a point within the entire video/audio stream 500. TOC 630 include one or more content labels, each indexed to a corresponding time stamp in video stream 500, as defined by TOC time markers 791, 792, 793, 794 in LiveScreen display 600.

Detailed Description Text (28):
Referring now to FIG. 9, in one embodiment of the present invention, client computer 240 includes a web browser 950 and a browser plug-in module 952 for interfacing web browser 950 with a main client module 960. Client module 960 includes an event registry 962, playout buffer(s) 966, video/audio decoder(s) 964, video/audio renderer(s) 965 and one or more dynamically loadable event applet(s), e.g., flipper applet 967, ticker applet 968 and VCR applet 969. In this embodiment, event registry 962 also functions as an annotation interpreter 963.

Detailed Description Text (29):
FIGS. 10A is a flowchart illustrating the operation of client module 960. Assume that viewer 249 has not previously loaded client module 960 in client computer 240, but has already loaded a web browser 950, e.g., Netscape's Navigator (step 1010). Viewer 249 surfs the world-wide web (www) via the internet and locates a web site of interest to viewer 249. Typically, the web site of interest is hosted on web server 230. Accordingly, a target web page is downloaded from web server 230 and displayed on client computer 240.

Detailed Description Text (30):
The target web page includes a link to a customized LiveScreen display, e.g., display 600. If client module 960 has not been previously loaded, client module 960 is now loaded over web browser 950 for processing video/audio and annotation streams (step 1020). Depending on the implementation, a copy of client module 960 may be available from the web site of interest. Alternatively, the target web page may provide a HTML link to another web server which has an updated copy of client module 960.

Detailed Description Text (31):
Referring now to FIG. 10B, first, browser plug-in module 952 is installed over web browser 950 (step 1022). As discussed above, plug-in module 952 provides the interface between client module 960 and web browser 950. The target web page provides a HTML link to the format for LiveScreen display 600. The LiveScreen display format is retrieved and display 600 is installed on client computer 240 using web browser 950 (step 1024).

Detailed Description Text (33):
Referring back to FIG. 10A, encoded video/audio frames and associated annotation frames are streamed from stream server 220 to client computer 240 for synchronous display (step 1030). Streaming video and audio streams over a network is very efficient because streaming eliminates the need for a large buffer at client computer 240. In addition, streaming also provides flexibility, e.g., switching video sources midstream is possible without wasting network resources since streaming is based on a pseudo just-in-time (JIT) protocol and does not involve downloads of the entire video stream prior to display at client computer 240. If the underlying transmission protocol is HTTP, then video, audio and annotation packets are initially "pulled" by client computer 240 from server 220 using HTTP "get" packet(s).

Detailed Description Text (34):
Next, the encoded video/audio streams are decoded by decoder 964, i.e., decompressed using a suitable technique, and then displayed at client computer 240 by renderer 965 (step 1040). (See co-pending applications VXT 702, 712 and 718).

Detailed Description Text (37):
Further, since the video and annotation streams are handled synchronously but separately by video decoder 964 and annotation interpreter 963, respectively, steps 1040 and 1050 can occur concurrently or consecutively. As discussed above, event registry 962 is capable of dynamic registration of event applets. Accordingly, annotation interpreter 963 is adaptable, and capable of automatic installation and linking of new event applet(s) to add new class(es) of displayable events for client computer 240.

Detailed Description Text (38):
After registering with event registry 962, flipper applet 967 provides the location of the flipper stream to browser 950 which then begin receiving the flipper stream from stream server 220. Flipper annotation frames are provided by stream server 220 synchronously with the video/audio frames to client module 960 so that the annotations, i.e., displayable events can be synchronized for display at client computer 240 (step 1060). In this example, URL addresses, for synchronizing HTML page flips with video stream are provided to web browser 950 thereby permitting client computer 240 to subsequently retrieve and display various textual and graphical elements changing at predetermined points corresponding to the timeline of the video stream. Note that HTML pages can be retrieved from one or more web server(s) 230.

Detailed Description Text (39):
Similarly, after registering with event registry 962, ticker (tape) applet 968 provides the location of the ticker stream to browser 950 which then begins receiving the ticker stream from stream server 220. Ticker annotation frames are provided by stream server 220 synchronously with the video/audio frames so that the annotations, i.e., displayable ticker data can be synchronized for display at client computer 240 at predetermined points corresponding to the timeline of the video stream.

Detailed Description Text (42):
As shown in FIG. 11, a table of content 630 with content labels enables viewer 249 to skip forward or backward to predetermined locations in the video/audio stream. First, viewer 249 selects a content label of interest (step 1110). Examples of suitable content labels are section headings of the video stream. Next, client module 960 sends a message to stream server 220 with the time stamp of an I-frame from the video stream whose location is close to selected content label (step 1120). In this embodiment, an I-frame is a video frame which includes data for a complete video frame. Although computationally more intensive, it is also possible to select a P-frame and then reconstructed a complete video starting from a neighboring I-frame close to the selected P-frame.

CLAIMS:

1. In a computer system, a method for generating a synchronization script configured to orchestrate a synchronized display of a video stream and displayable elements on a display device of a client computer, said video stream including a plurality of video frames, each said video frame associated with a time stamp, the method comprising:

generating a first annotation stream for inclusion in said synchronization script, said first annotation stream including a first plurality of annotation frames, said first plurality of annotation frames associated with a first selected subset of said video frames, each said first plurality of annotation frames including an event locator and an event time marker, each said event locator pointing to the location of one of a first plurality of displayable elements stored in a web server coupled to said client computer, said event time markers of said first plurality of annotation frames corresponding to the respective time stamps of said first selected subset of video frames.

5. In a computer system, a method for generating a synchronization script configured to orchestrate a synchronized display of a video stream and displayable elements on a display device of a client computer, said video stream including a plurality of video frames, each said video frame associated with a time stamp, the method comprising:

generating at least one annotation stream for inclusion in said synchronization script, said at least one annotation stream including a plurality of annotation frames, said annotation frames associated with a selected subset of said video frames, each said annotation frame including a corresponding one of said displayable events and an event time marker, said time markers of said annotation frames corresponding to the respective time stamps of said selected subset of video frames.

7. In a client computer having a display device, a method of skipping forward or backward to a predetermined one of a plurality of video frames of a video stream being displayed on said display device, each said video frame including a time stamp, and wherein a table of contents is also displayed on said display device, the method comprising:

receiving said video stream from a stream server coupled to the client computer via a computer network;

sequentially displaying said video frames on said display device, starting from an initial video frame of said video stream;

selecting a content label from said table of contents, said content label providing an index into an intermediate video frame of said video stream, said index based on the time stamp of said intermediate video frame;

communicating said index to said stream server;

receiving said video stream from said stream server, starting from said intermediate video frame; and

sequentially displaying said video frames on said display device, starting with said intermediate video frame.

8. In a stream server, a method of causing a client computer to skip forward or backward to a predetermined one of a plurality of video frames of a video stream being displayed on a display device of said client computer, said stream server coupled to the client computer via a computer network, each said video frame including a time stamp, and wherein a table of content is also displayed on said display device, the method comprising:

streaming said video stream to said client computer for sequential display on said display device, starting from an initial video frame of said video stream;

receiving an index from said client computer, said index associated with a selectable content label from a table of contents displayed on said display device, said index based on the time stamp of an intermediate video frame of said video stream; and

streaming said video stream to said client computer for sequential display on said display device, starting from said intermediate video frame.

9. A producer useful for generating a synchronization script configured to orchestrate a synchronized display of a video stream and displayable elements on a display device of a client computer, the producer comprising:

a capture module configured to capture said video stream which includes a plurality of video frames, each said video frame associated with a time stamp; and

an author module configured to generate a first annotation stream for inclusion in said synchronization script, said first annotation stream including a first plurality of annotation frames, said first plurality of annotation frames associated with a first selected subset of said video frames, each said first plurality of annotation frames including an event locator and an event time marker, each said event locator pointing to the location of one of a first plurality of displayable elements stored in a web server coupled to said client computer, said event time markers of said first plurality of annotation frames corresponding to the respective time stamps of said first selected subset of video frames.

13. A producer useful for generating a synchronization script configured to orchestrate a synchronized display of a video stream and displayable elements on a display device of a client computer, the producer comprising:

a capture module configured to capture said video stream which includes a plurality of video frames, each said video frame associated with a time stamp; and

an author module configured to generate at least one annotation stream for inclusion in said synchronization script, said at least one annotation stream including a plurality of annotation frames, said annotation frames associated with a selected subset of said

video frames, each said annotation frame including a corresponding one of said displayable events and an event time marker, said time markers of said annotation frames corresponding to the respective time stamps of said selected subset of video frames.

15. A client computer useful in association with a stream server coupled to the client computer via a computer network, the client computer comprising:

a playout buffer configured to receive a video stream from said stream server, said video stream including a plurality of video frames, each said video frame including a time stamp;

a display device configured to sequentially display said video frames on said display device, starting from an initial video frame of said video stream, said display device also configured to display a selectable content label from said table of contents, said selectable content label providing an index into an intermediate video frame of said video stream, said index based on the time stamp of said intermediate video frame; and

a transmitter configured to communicate said index to said stream server, thereby causing said stream server to begin transmitting said video stream to said client computer, starting from said intermediate video frame, and causing said display device to sequentially display said video frames, starting with said intermediate video frame.

16. A stream server useful in association with a client computer coupled to said stream server via a computer network, the stream server comprising:

a streamer configured to store and stream a video stream to said client computer, said video stream including a plurality of video frames, said video stream enabling said client computer to sequentially display said video frames on a display device of said client computer, starting from an initial video frame of said video stream; and

a receiver configured to receive an index from said client computer, said index associated with a selectable content label from a table of contents displayed on said display device, said index based on the time stamp of an intermediate video frame of said video stream, and wherein said received index causes said streamer to begin streaming said video stream to said client computer, and enabling said client computer to sequentially display said video frames on said display device starting from said intermediate video frame.

17. A computer-readable medium useful in association with a computer system, the computer-readable medium having computer-executable instructions which cause the computer system to perform a method comprising generating a first annotation stream which includes a first plurality of annotation frames, said first plurality of annotation frames associated with a first selected subset of a plurality of video frames of a video stream, each said video frame associated with a time stamp, each said first plurality of annotation frames including an event locator and an event time marker, each said event locator pointing to the location of one of a first plurality of displayable elements stored in a web server coupled to said client computer, said event time markers of said first plurality of annotation frames corresponding to the respective time stamps of said first selected subset of video frames.

21. A computer-readable medium useful in association with a computer system, the computer-readable medium having computer-executable instructions which cause the computer system to perform a method comprising generating at least one annotation stream which includes a plurality of annotation frames, said annotation frames associated with a selected subset of a plurality of video frames of a video stream, each said video frame associated with a time stamp, each said annotation frame including a corresponding one of said displayable events and an event time marker, said time markers of said annotation frames corresponding to the respective time stamps of said selected subset of video frames.

WEST

Generate Collection

L10: Entry 14 of 26 File: USPT Jan 9, 2001

DOCUMENT-IDENTIFIER: US 6173317 B1
TITLE: Streaming and displaying a video stream with synchronized annotations over a computer network

Abstract Text (1):
Client computer(s) retrieve and display synchronized annotated multimedia streams from servers dispersed over a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the internet. Multimedia streams provided to the client computer(s) can include a compressed video stream for display in a video window and an accompanying compressed audio stream. Annotations, i.e., displayable events, include textual/graphical data in the form of HTML pages with Java applets to be displayed in one or more event windows. The video/audio and annotation streams are produced and then stored in stream server(s). Annotation streams include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream. Examples of embedded displayable data include ticker tape data embedded within the annotation stream. Examples of event locators to displayable events include URL addresses pointing to HTML web pages. Video/audio streams and annotation streams are provided by the stream server(s) to the client computer(s) in a coordinated manner, so that the client computer(s) is able to synchronously display the video frames and displayable event(s) in a video window and event window(s), respectively.

Application Filing Date (1):
19970314

Parent Case Text (2):
This application is related to co-pending U.S. application Ser. No. 08/818,805, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Motion Detection in Video Compression," U.S. application Ser. No. 08/819,507, filed Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method," U.S. application Ser. No. 08/818,804, filed on Mar. 14, 1997, entitled "Production of a Video Stream with Synchronized Annotations over a Computer Network," U.S. application Ser. No. 08/819,586, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Control Functions in a Streamed Video Display System," U.S. application Ser. No. 08/818,769, filed on Mar. 14, 1997, entitled "Method and Apparatus for Automatically Detecting Protocols in a Computer Network," U.S. application Ser. No. 08/818,127, filed on Mar. 14, 1997, entitled "Dynamic Bandwidth Selection for Efficient Transmission of Multimedia Streams in a Computer Network," U.S. application Ser. No. 08/819,585, filed on Mar. 14, 1997, entitled "Streaming and Display of a Video Stream with Synchronized Annotations over a Computer Network," U.S. application Ser. No. 08/818,664, filed on Mar. 14, 1997, entitled "Selective Retransmission for Efficient and Reliable Streaming of Multimedia Packets in a Computer Network," U.S application Ser. No. 08/819,579, filed Mar. 14, 1997, entitled "Method and Apparatus for Table-Based Compression with Embedded Coding," U.S. application Ser. No. 08/818,826, filed on Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method," all filed concurrently herewith, U.S. application Ser. No. 08/822,156, filed on Mar. 17, 1997, entitled "Method and Apparatus for Communication Media Commands and Data Using the HTTP Protocol," provisional U.S. application Ser. No. 60/036,662, filed on Jan. 30, 1997, entitled "Methods and Apparatus for Autodetecting Protocols in a Computer Network," U.S. application Ser. No. 08/625,650, filed on Mar. 29, 1996, entitled "Table-Based Low-Level Image Classification System," U.S. application Ser. No. 08/714,447, filed on Sep. 16, 1996, entitled "Multimedia Compression System with Additive Temporal Layers," and is a continuation-in-part of U.S. application Ser. No. 08/623,299, filed on Mar. 28, 1996, entitled "Table-Based Compression with Embedded Coding," which are all

incorporated by reference in their entirety for all purposes.

Brief Summary Text (6):
Existing conventional internet applications, such as electronic mailers and web browers, are capable of transferring and presenting textual and graphical information. However, none of these individual internet applications effectively provide synchronous delivery of a combination of diverse multimedia streams in a coherent and integrated manner. This is because executing several independent and unrelated applications to present the diverse combination of multimedia streams on a client computer can result in a hodgepodge of poor quality, incompatible and/or incoherent presentations.

Brief Summary Text (7):
In view of the foregoing, there are desired improved techniques for reliably providing a multimedia stream such as a video and audio stream, together with annotations such as textual and graphical information in an integrated seamless package to client computer(s), while efficiently utilizing the network resources and consuming minimal computational cycles on the client computer(s).

Brief Summary Text (9):
The present invention enables client computer(s) to retrieval and display synchronized annotated multimedia streams from servers dispersed over a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the internet. Multimedia streams provided to the client computer(s) can include a compressed video stream for display in a video window and an accompanying compressed audio stream. Annotations, i.e., displayable events, include textual/graphical data in the form of HTML pages with Java applets to be displayed in one or more event windows.

Brief Summary Text (10):
In one embodiment, the video/audio and annotation streams are produced by a capture module and an author module, and then stored in stream server(s) to be provided to one or more client computer(s) upon request. The capture module compresses the video stream using a suitable compression format, depending on the desired resolution(s) and frame rate(s). The author module then generates synchronization scripts which include annotation streams which are synchronized with the compressed video/audio streams.

Brief Summary Text (11):
In this embodiment, annotation streams include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream. Examples of embedded displayable data include ticker tape data embedded within the annotation stream. Examples of event locators to displayable events include URL addresses pointing to HTML web pages. Note that an event time marker need not be identical to a corresponding video time stamp. The client computer is capable of switching to a new displayable event together with a video frame or in between two video frames.

Brief Summary Text (13):
The client computer also provides a table of contents displayed concurrently with the video window and the event window. The table of contents includes content labels which enable the viewer to skip forward or backward to one or more predetermined locations in the video stream.

Drawing Description Text (5):
FIG. 4A is a flowchart illustrating the capture of a live video/audio stream from a video camera or from a previously stored video file.

Drawing Description Text (7):
FIG. 5 shows an exemplary format for storing and delivering a compressed video stream.

Drawing Description Text (11):
FIG. 9 illustrates one embodiment of the client computer which includes a web browser and a browser plug-in module for interfacing a web browser with a client module.

Detailed Description Text (13):
FIG. 2 is a block diagram showing an exemplary hardware environment for practicing the annotated video-on-demand (VOD) system of the present invention. The VOD system includes a production station 210, a stream server 220, at least one web server 230 and

at least one client computer 240, each of which can be implemented using computer system 100 described above. Stream server 220 and web server 230 are coupled to client computer 240 via a computer network 290, e.g., the internet. Note that the disclosed hardware environment is exemplary. For example, production station 210 and stream server 220 can be implemented using two separate computer systems or using one computer system. In addition, if production station 210 and stream server 220 are implemented on separate computer systems as shown in FIG. 2, an optional direct connection (not shown) between production station 210 and stream server 220 can provide faster uploads of compressed video and annotation streams. In the following description, an audio stream optionally accompanies each video stream.

Detailed Description Text (14):
A producer 215, installed in production station 210, is a user-friendly tool for use by a designer 219 to create a synchronization script which includes annotation stream(s). The annotation stream(s) define the content(s) of a LiveScreen display 245 to be displayed on client computer 240 for a viewer 249. LiveScreen 245 display provides a graphical user interface (GUI) with multiple windows for synchronously displaying a video stream from stream server 220 and at least one displayable event stream. Examples of displayable events include textual/graphical information such as HTML-scripted web page(s) from web server 230.

Detailed Description Text (15):
In one embodiment, as shown in FIG. 3, producer 215 includes a capture module 317 and an author module 318. Production station 210 includes 16 MB of RAM and a 1 GB hard disk drive for capturing and storing an uncompressed or precompressed video stream. Sources for generating video streams include a video camera 312, a video cassette recorder (VCR) (not shown) or a previously digitized video file 314, e.g., a Video for Windows (.avi) file. For ease of installation and use by designer 219, producer 215 is implemented in a host environment which includes a window-based operating system such as Microsoft Windows 95 and a web browser such as Netscape's Navigator 3.x. (Appendix A is a detailed user manual for one implementation of producer 215).

Detailed Description Text (16):
Referring also to the flowchart of FIG. 4A, in step 410 capture module 317 captures a live video/audio stream from video camera 312 or from the previously stored video file 314. If video camera 312 provides an analog video stream, e.g., an NTSC signal, a hardware capture card (not shown) provides the required conversion from the analog video stream to a digitized video stream. Because temporary storage of uncompressed video data is memory intensive, some form of pre-compression can be used to reduce the memory storage requirement of the input video stream during capture step 410 and prior to compression step 420.

Detailed Description Text (17):
In step 420, capture module 420 compresses the digitized video stream using a suitable compression technique. In this embodiment, depending on the bandwidth capacity of the connection provided by network 290 between stream server 220 and client computer 240, e.g., a POTS modem, ISDN or Ethernet, a suitable frame resolution and frame rate combination is selected. A compression algorithm based on the H263 standard (see co-pending applications VXT 702 and 718) is used for compressing lower bandwidth video streams, e.g., at less than 56 kbps. Alternatively, a Vxpress format (see co-pending application VXT 712) is used for compressing higher bandwidth video streams. FIG. 5 shows an exemplary format 500 for storing and delivering a compressed video stream.

Detailed Description Text (21):
Designer 219 may view frames from video stream 500 displayed in video window 720 for referencing and selecting appropriate time stamps to use in generating annotation streams. Within video window 720, VCR function buttons, e.g., a rewind button 724, a play button 726 and a fast forward button 728, are available for designer 219 to quickly traverse video stream 500. Since video window 720 is provided as a convenience for designer 219, if designer 219 has prior knowledge of the content of the video stream, designer 219 may proceed with the generation of the annotation streams without viewing video window 720.

Detailed Description Text (27):
In accordance with another aspect of the invention, LiveScreen display 600 also includes a table of contents (TOC) 630, enabling viewer 249 at client computer 240 to skip forward or backward to a point within the entire video/audio stream 500. TOC 630 include one or more content labels, each indexed to a corresponding time stamp in video stream 500, as defined by TOC time markers 791, 792, 793, 794 in LiveScreen display

600.

Detailed Description Text (28):
Referring now to FIG. 9, in one embodiment of the present invention, client computer 240 includes a web browser 950 and a browser plug-in module 952 for interfacing web browser 950 with a main client module 960. Client module 960 includes an event registry 962, playout buffer(s) 966, video/audio decoder(s) 964, video/audio renderer(s) 965 and one or more dynamically loadable event applet(s), e.g., flipper applet 967, ticker applet 968 and VCR applet 969. In this embodiment, event registry 962 also functions as an annotation interpreter 963.

Detailed Description Text (29):
FIG. 10A is a flowchart illustrating the operation of client module 960. Assume that viewer 249 has not previously loaded client module 960 in client computer 240, but has already loaded a web browser 950, e.g., Netscape's Navigator (step 1010). Viewer 249 surfs the world-wide web (www) via the internet and locates a web site of interest to viewer 249. Typically, the web site of interest is hosted on web server 230. Accordingly, a target web page is downloaded from web server 230 and displayed on client computer 240.

Detailed Description Text (30):
The target web page includes a link to a customized LiveScreen display, e.g., display 600. If client module 960 has not been previously loaded, client module 960 is now loaded over web browser 950 for processing video/audio and annotation streams (step 1020). Depending on the implementation, a copy of client module 960 may be available from the web site of interest. Alternatively, the target web page may provide a HTML link to another web server which has an updated copy of client module 960.

Detailed Description Text (31):
Referring now to FIG. 10B, first, browser plug-in module 952 is installed over web browser 950 (step 1022). As discussed above, plug-in module 952 provides the interface between client module 960 and web browser 950. The target web page provides a HTML link to the format for LiveScreen display 600. The LiveScreen display format is retrieved and display 600 is installed on client computer 240 using web browser 950 (step 1024).

Detailed Description Text (33):
Referring back to FIG. 10A, encoded video/audio frames and associated annotation frames are streamed from stream server 220 to client computer 240 for synchronous display (step 1030). Streaming video and audio streams over a network is very efficient because streaming eliminates the need for a large buffer at client computer 240. In addition, streaming also provides flexibility, e.g., switching video sources midstream is possible without wasting network resources since streaming is based on a pseudo just-in-time (JIT) protocol and does not involve downloads of the entire video stream prior to display at client computer 240. If the underlying transmission protocol is HTTP, then video, audio and annotation packets are initially "pulled" by client computer 240 from server 220 using HTTP "get" packet(s).

Detailed Description Text (34):
Next, the encoded video/audio streams are decoded by decoder 964, i.e., decompressed using a suitable technique, and then displayed at client computer 240 by renderer 965 (step 1040). (See co-pending applications VXT 702, 712 and 718).

Detailed Description Text (37):
Further, since the video and annotation streams are handled synchronously but separately by video decoder 964 and annotation interpreter 963, respectively, steps 1040 and 1050 can occur concurrently or consecutively. As discussed above, event registry 962 is capable of dynamic registration of event applets. Accordingly, annotation interpreter 963 is adaptable, and capable of automatic installation and linking of new event applet(s) to add new class(es) of displayable events for client computer 240.

Detailed Description Text (38):
After registering with event registry 962, flipper applet 967 provides the location of the flipper stream to browser 950 which then begin receiving the flipper stream from stream server 220. Flipper annotation frames are provided by stream server 220 synchronously with the video/audio frames to client module 960 so that the annotations, i.e., displayable events can be synchronized for display at client computer 240 (step 1060). In this example, URL addresses, for synchronizing HTML page flips with video stream are provided to web browser 950 thereby permitting client computer 240 to

subsequently retrieve and display various textual and graphical elements changing at predetermined points corresponding to the timeline of the video stream. Note that HTML pages can be retrieved from one or more web server(s) 230.

Detailed Description Text (39):
Similarly, after registering with event registry 962, ticker (tape) applet 968 provides the location of the ticker stream to browser 950 which then begins receiving the ticker stream from stream server 220. Ticker annotation frames are provided by stream server 220 synchronously with the video/audio frames so that the annotations, i.e., displayable ticker data can be synchronized for display at client computer 240 at predetermined points corresponding to the timeline of the video stream.

Detailed Description Text (42):
As shown in FIG. 11, a table of content 630 with content labels enables viewer 249 to skip forward or backward to predetermined locations in the video/audio stream. First, viewer 249 selects a content label of interest (step 1110). Examples of suitable content labels are section headings of the video stream. Next, client module 960 sends a message to stream server 220 with the time stamp of an I-frame from the video stream whose location is close to selected content label (step 1120). In this embodiment, an I-frame is a video frame which includes data for a complete video frame. Although computationally more intensive, it is also possible to select a P-frame and then reconstructed a complete video starting from a neighboring I-frame close to the selected P-frame.

CLAIMS:

1. In a client computer having a processor, memory and a display device, said client computer coupled to a stream server and at least one web server via a network, a method for synchronizing the display of video frames of a video stream with the display of displayable events, said method comprising the steps of:

receiving a plurality of video frames of said video stream from said stream server for display in a video window of said display device, each said video frame associated with a time stamp;

displaying said video frames in said video window;

receiving a first plurality of annotation frames of a first annotation stream from said stream server;

interpreting said first plurality of annotation frames which is associated with a first selected subset of said video frames, each of said first plurality of annotation frames including an event locator and an event time marker, and wherein said event time markers of said first plurality of annotation frames corresponds to the respective time stamps of said first selected subset of video frames, and each said event locator points to one of a first plurality of displayable events stored in said at least one web server; and

retrieving and synchronously displaying in a first event window of said display device the displayable event pointed to by the event locator of each of said first plurality of annotation frames whenever the event time marker of each of said first plurality of annotation frames matches the time stamp associated with the video frame currently being displayed in said video window.

4. The method of claim 1 wherein said video server and said web server are part of a server computer system.

6. In a stream server having a processor and memory, said stream server coupled to a client computer and at least one web server via a network, said client computer having a processor, memory and a display device, a method for streaming video and annotation streams to synchronize the display of video frames of a video stream with the display of displayable events, said method comprising the steps of:

streaming a plurality of video frames of said video stream from said stream server to said client computer for display in a video window of said display device, each said video frame associated with a time stamp; and

synchronously streaming a first plurality of annotation frames of a first annotation stream from said stream server to said client computer, said first plurality of

annotation frames associated with a first selected subset of said video frames, each of said first plurality of annotation frames including an event locator and an event time marker, and wherein each said event locator points to one of a first plurality of displayable events stored in said at least one web server, said event time markers of said first plurality of annotation frames corresponds to the respective time stamps of said first selected subset of video frames, and said video stream and said first annotation stream are synchronized using said respective time stamps of said first selected subset of said video frames and said event time markers of said first plurality of annotation frames.

8. The method of claim 6 wherein comprising the step of:

synchronously streaming a second plurality of annotation frames of a second annotation stream from said stream server to said client computer, said second plurality of annotation frames associated with a second selected subset of said video frames, each of said second plurality of annotation frames including a corresponding one of a second plurality of displayable events and an event time marker, and wherein said event time markers of said second plurality of annotation frames corresponds to the respective time stamps of said second selected subset of video frames, and said video stream and said annotation stream are synchronized using said respective time stamps of said second selected subset of said video frames and said event time markers of said second plurality of annotation frames.

10. In a client computer having a processor, memory and a display device, said client computer coupled to a stream server via a network, a method for synchronizing the display of video frames of a video stream and the display of a plurality of displayable events, wherein said video stream and said plurality of displayable events are to be displayed concurrently in a video window and an event window, respectively, of said display device, said method comprising the steps of:

receiving a plurality of video frames of said video stream from said stream server for display in said video window, each said video frame associated with a time stamp;

displaying said video frames in said video window;

receiving a plurality of annotation frames of an annotation stream from said stream server;

interpreting said plurality of annotation frames, said plurality of annotation frames associated with a selected subset of said video frames, each of said plurality of annotation frames including a corresponding one of said displayable events and an event time marker, and wherein said event time markers of said plurality of annotation frames corresponds to the respective time stamps of said selected subset of video frames; and

synchronously displaying in said event window said one corresponding displayable event whenever the event time marker of each of said plurality of annotation frames matches the time stamp associated with the video frame currently being displayed in said video window.

12. In a stream server having a processor and memory, said stream server coupled to a client computer via a network, said client computer having a processor, memory and a display device, a method for streaming video and annotation streams to synchronize the display of video frames of said video stream with the display of a plurality of displayable events, wherein said video stream and said plurality of displayable events are to be displayed concurrently in a video window and a first event window, respectively, of said display device, said method comprising the steps of:

streaming a plurality of video frames of said video stream from said stream server to said client computer for display in said video window, each said video frame associated with a time stamp; and

synchronously streaming a plurality of annotation frames of an annotation stream from said stream server to said client computer, said plurality of annotation frames associated with a selected subset of said video frames, each of said plurality of annotation frames including a corresponding one of said displayable events and an event time marker, and wherein said event time markers of said plurality of annotation frames corresponds to the respective time stamps of said selected subset of video frames, and said video stream and said annotation stream are synchronized using said respective time stamps and said event time markers.

14. A client computer useful in association with a stream server and at least one web server, said client computer comprising:

a playout buffer configured to receive a plurality of video frames of a video stream from said stream server, each said video frame associated with a time stamp;

an annotation interpreter configured to receive and interpret a first plurality of annotation frames of a first annotation stream from said stream server, said first plurality of annotation frames associated with a first selected subset of said video frames, each of said first plurality of annotation frames including an event locator and an event time marker, and wherein said event time markers of said first plurality of annotation frames corresponds to the respective time stamps of said first selected subset of video frames, and each said event locator points to one of a first plurality of displayable events stored in said at least one web server; and

a display device configured to display said video frames in a video window of said display device and further configured to synchronously display in a first event window of said display device the displayable event pointed to by the event locator of each of said first plurality of annotation frames whenever the event time marker of each of said first plurality of annotation frames matches the time stamp associated with the video frame currently being displayed in said video window.

17. The client computer of claim 14 wherein said video server and said web server are part of a server computer system.

19. A stream server useful in association with a client computer and at least one web server, said client computer having a display device, the stream server comprising:

memory configured to store a plurality of video frames of said video stream to be streamed from said stream server to said client computer for display in a video window of said display device, each said video frame associated with a time stamp; and

wherein said memory is further configured to store a first plurality of annotation frames of a first annotation stream to be synchronously streamed from said stream server to said client computer, said first plurality of annotation frames associated with a first selected subset of said video frames, each of said first plurality of annotation frames including an event locator and an event time marker, and wherein each said event locator points to one of a first plurality of displayable events stored in said at least one web server, said event time markers of said first plurality of annotation frames corresponds to the respective time stamps of said first selected subset of video frames, and said video stream and said first annotation stream are synchronized using said respective time stamps of said first selected subset of said video frames and said event time markers of said first plurality of annotation frames.

21. The stream server of claim 19 wherein said memory is further configured to store a second plurality of annotation frames of a second annotation stream to be synchronously streamed from said stream server to said client computer, said second plurality of annotation frames associated with a second selected subset of said video frames, each of said second plurality of annotation frames including a corresponding one of a second plurality of displayable events and an event time marker, and wherein said event time markers of said second plurality of annotation frames corresponds to the respective time stamps of said second selected subset of video frames, and said video stream and said annotation stream are synchronized using said respective time stamps of said second selected subset of said video frames and said event time markers of said second plurality of annotation frames.

23. A client computer useful in association with a stream server, said client computer comprising:

a playout buffer configured to receive a plurality of video frames of said video stream from said stream server, each said video frame associated with a time stamp;

an annotation interpreter configured to receive and interpret a plurality of annotation frames of an annotation stream from said stream server, said plurality of annotation frames associated with a selected subset of said video frames, each of said plurality of annotation frames including a corresponding one of said displayable events and an event time marker, and wherein said event time markers of said plurality of annotation frames corresponds to the respective time stamps of said selected subset of video

frames; and

a display device configured to display said video frames in a video window of said display device, and further configured to synchronously display in an event window of said display device said one corresponding displayable event whenever the event time marker of each of said plurality of annotation frames matches the time stamp associated with the video frame currently being displayed in said video window.

25. A stream server useful in association with a client computer, said client computer having a display device, the stream server comprising:

memory configured to store a plurality of video frames of said video stream to be streamed from said stream server to said client computer for display in a video window of said display device, each said video frame associated with a time stamp; and

wherein said memory is further configured to store a plurality of annotation frames of an annotation stream to be synchronously streamed from said stream server to said client computer, said plurality of annotation frames associated with a selected subset of said video frames, each of said plurality of annotation frames including a corresponding one of a plurality of displayable events and an event time marker, and wherein said event time markers of said plurality of annotation frames corresponds to the respective time stamps of said selected subset of video frames, and said video stream and said annotation stream are synchronized using said respective time stamps of said selected subset of said video frames and said event time markers of said plurality of annotation frames.

27. A computer-readable medium useful in association with a client computer having a processor, memory and a display device, said client computer coupled to a stream server and at least one web server via a network, the computer-readable medium comprising computer-readable code instructions configured to cause said client computer to execute the steps of:

receiving a plurality of video frames of a video stream from said stream server for display in a video window of said display device, each said video frame associated with a time stamp;

displaying said video frames in said video window;

receiving a first plurality of annotation frames of a first annotation stream from said stream server;

interpreting said first plurality of annotation frames which is associated with a first selected subset of said video frames, each of said first plurality of annotation frames including an event locator and an event time marker, and wherein said event time markers of said first plurality of annotation frames corresponds to the respective time stamps of said first selected subset of video frames, and each said event locator points to one of a first plurality of displayable events stored in said at least one web server; and

retrieving and synchronously displaying in a first event window of said display device the displayable event pointed to by the event locator of each of said first plurality of annotation frames whenever the event time marker of each of said first plurality of annotation frames matches the time stamp associated with the video frame currently being displayed in said video window.

30. The computer-readable medium of claim 27 wherein said video server and said web server are part of a server computer system.

32. A computer-readable medium useful in association with a stream server having a processor and memory, said stream server coupled to a client computer and at least one web server via a network, said client computer having a processor, memory and a display device, the computer-readable medium comprising computer-readable code instructions configured to cause said stream server to execute the steps of:

streaming a plurality of video frames of a video stream from said stream server to said client computer for display in a video window of said display device, each said video frame associated with a time stamp; and

synchronously streaming a first plurality of annotation frames of a first annotation

stream from said stream server to said client computer, said first plurality of annotation frames associated with a first selected subset of said video frames, each of said first plurality of annotation frames including an event locator and an event time marker, and wherein each said event locator points to one of a first plurality of displayable events stored in said at least one web server, said event time markers of said first plurality of annotation frames corresponds to the respective time stamps of said first selected subset of video frames, and said video stream and said first annotation stream are synchronized using said respective time stamps of said first selected subset of said video frames and said event time markers of said first plurality of annotation frames.

34. The computer-readable medium of claim 32 further comprising computer-readable code instructions configured to cause said stream server to execute the step of:

synchronously streaming a second plurality of annotation frames of a second annotation stream from said stream server to said client computer, said second plurality of annotation frames associated with a second selected subset of said video frames, each of said second plurality of annotation frames including a corresponding one of a second plurality of displayable events and an event time marker, and wherein said event time markers of said second plurality of annotation frames corresponds to the respective time stamps of said second selected subset of video frames, and said video stream and said annotation stream are synchronized using said respective time stamps of said second selected subset of said video frames and said event time markers of said second plurality of annotation frames.

36. A computer-readable medium useful in association with a client computer having a processor, memory and a display device, said client computer coupled to a stream server via a network, the computer-readable medium comprising computer-readable code instructions configured to cause said client computer to execute the steps of:

receiving a plurality of video frames of a video stream from said stream server for display in a video window of said display device, each said video frame associated with a time stamp;

displaying said video frames in said video window;

receiving a plurality of annotation frames of an annotation stream from said stream server;

interpreting said plurality of annotation frames, said plurality of annotation frames associated with a selected subset of said video frames, each of said plurality of annotation frames including a corresponding one of a plurality of displayable events and an event time marker, and wherein said event time markers of said plurality of annotation frames corresponds to the respective time stamps of said selected subset of video frames; and

synchronously displaying in an event window of said display device said one corresponding displayable event whenever the event time marker of each of said plurality of annotation frames matches the time stamp associated with the video frame currently being displayed in said video window.

38. A computer-readable medium useful in association with a stream server having a processor and memory, said stream server coupled to a client computer via a network, said client computer having a processor, memory and a display device, the computer-readable medium comprising computer-readable code instructions configured to cause said stream server to execute the steps of:

streaming a plurality of video frames of a video stream from said stream server to said client computer for display in a video window of said display device, each said video frame associated with a time stamp; and

synchronously streaming a plurality of annotation frames of an annotation stream from said stream server to said client computer, said plurality of annotation frames associated with a selected subset of said video frames, each of said plurality of annotation frames including a corresponding one of said displayable events and an event time marker, and wherein said event time markers of said plurality of annotation frames corresponds to the respective time stamps of said selected subset of video frames, and said video stream and said annotation stream are synchronized using said respective time stamps and said event time markers.

WEST

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L10: Entry 13 of 26 File: USPT May 8, 2001

DOCUMENT-IDENTIFIER: US 6230172 B1
TITLE: Production of a video stream with synchronized annotations over a computer network

Abstract Text (1):
The production of synchronization scripts and associated annotated multimedia streams for servers and client computers coupled to each other by a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the intermet. Annotated multimedia streams can include a compressed video stream for display in a video window, an accompanying compressed audio stream and annotations. Synchronization scripts include annotation streams for synchronizing the display of video streams with annotations, e.g., displayable events, such textual/graphical data in the form of HTML pages with Java applets to be displayed in one or more event windows. The producer includes a capture module and an author module for capturing video streams and generating annotation streams, respectively. The capture module compresses the video stream using a suitable compression format. Annotation streams include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream. Embedded displayable data include ticker tape data embedded within the annotation stream. Examples of event locators to displayable events include URL addresses pointing to HTML web pages. The video/audio streams and annotation streams are stored in stream server(s) for subsequent retrieval by client computer(s) in a coordinated manner, so that the client computer(s) is able to synchronously display the video frames and displayable event(s) in a video window and event window(s), respectively. In one implementation, annotation streams include a flipper stream for locating HTML pages and a ticker stream which include ticker (tape) data.

Application Filing Date (1):
19990903

Parent Case Text (2):
This application is a continuation of U.S. Ser. No. 08/818,804 filed Mar. 14, 1997, now U.S. Pat. No. 6,006,241 which is related to co-pending U.S. application Ser. No. 08/818,805, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Motion Detection in Video Compression", U.S. application Ser. No. 08/819,507, filed on Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method, U.S. application Ser. No. 08/818,804, filed on Mar. 14, 1997, entitled "Production of a Video Stream with Synchronized Annotations over a Computer Network, U.S. application Ser. No. 08/819,586, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Control Functions in a Streamed Video Display System, U.S. application Ser. No. 08/818,769, filed on Mar. 14, 1997, entitled "Method and Apparatus for Automatically Detecting Protocols in a Computer Network", U.S. application Ser. No. 08/818,127, filed on Mar. 14, 1997, entitled "Dynamic Bandwidth Selection for Efficient Transmission of Multimedia Streams in a Computer Network", U.S. application Ser. No. 08/819,585, filed on Mar. 14, 1997, entitled "Streaming and Display of a Video Stream with Synchronized Annotations over a Computer Network", U.S. application Ser. No. 08/818,664, filed on Mar. 14, 1997, entitled "Selective Retransmission for Efficient and Reliable Streaming of Multimedia Packets in a Computer Network", U.S. application Ser. No. 08/819,579, filed on Mar. 14, 1997, entitled "Method and Apparatus for Table-Based Compression with Embedded Coding", U.S. application Ser. No. 08/819,587, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Motion Estimation in Video Compression", U.S. application Ser. No. 08/818,826, filed on Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method", all filed concurrently herewith, U.S. application Ser. No. 08/822,156, filed on Mar. 17, 1997,

entitled "Method and Apparatus for Communication Media Commands and Data Using the HTTP Protocol", provisional U.S. Application Serial No. 60/036,662, filed on Jan. 30, 1997, entitled "Methods and Apparatus for Autodetecting Protocols in a Computer Network" U.S. application Ser. No. 08/625,650, filed on Mar. 29, 1996, entitled "Table-Based Low-Level Image Classification System", U.S. application Ser. No. 08/714,447, filed on Sep. 16, 1996, entitled "Multimedia Compression System with Additive Temporal Layers", and is a continuation-in-part of U.S. application Ser. No. 08/623,299, filed on Mar. 28, 1996, entitled "Table-Based Compression with Embedded Coding", which are all incorporated by reference in their entirety for all purposes.

Brief Summary Text (6):
Existing conventional internet applications, such as electronic mailers and web browser, are capable of transferring and presenting textual and graphical information. However, none of these individual internet applications effectively provide synchronous delivery of a combination of diverse multimedia streams in a coherent and integrated manner. This is because executing several independent and unrelated applications to present the diverse combination of multimedia streams on a client computer can result in a hodgepodge of poor quality, incompatible and/or incoherent presentations.

Brief Summary Text (7):
In view of the foregoing, there are desired improved techniques for reliably providing a multimedia stream such as a video and audio stream, together with annotations such as textual and graphical information in an integrated seamless package to client computer(s), while efficiently utilizing the network resources and consuming minimal computational cycles on the client computer(s).

Brief Summary Text (9):
The present invention provides synchronization scripts and associated annotated multimedia streams for servers and client computers coupled to each other by a diverse computer network which includes local area networks (LANs) and/or wide area networks (WANs) such as the internet. Annotated multimedia streams can include a compressed video stream for display in a video window, an accompanying compressed audio stream and annotations. Synchronization scripts include annotation streams for synchronizing the display of video streams with annotations, e.g., displayable events, such textual/graphical data in the form of HTML pages with Java applets to be displayed in one or more event windows.

Brief Summary Text (10):
In one embodiment, a producer includes a capture module and an author module for capturing video streams and generating annotation streams, respectively. The video and annotation streams are then stored in stream server(s) to be provided to one or more client computer(s) upon request.

Brief Summary Text (11):
The capture module compresses the video stream using a compression format based on a standard H263, generating, for example, a QCIF resolution (176.times.144) video frames at 10-20 frames per second (fps) which can be encoded and transmitted over a 20 Kbps connection. Alternatively, using the scalable vector quantization (SVQ) compression algorithm of the present invention, dynamically scalable data transmission rates from 10Kbps to several Mbps can support scalable resolutions of 160.times.120 to 640.times.480 and frames rates ranging from 1 fps to 30 fps. Other compression techniques can also be used with the present invention.

Brief Summary Text (12):
In this embodiment, annotation streams include annotation frames which provide either pointer(s) to the event(s) of interest or include displayable data embedded within the annotation stream. Accordingly, each annotation frame includes either an event locator or an event data. In addition, each annotation frame includes an event time marker which corresponds to the time stamp(s) of associated video frame(s) within the video stream. Examples of embedded displayable data include ticker tape data embedded within the annotation stream. Examples of event locators to displayable events include URL addresses pointing to HTML web pages. Note that an event time marker need not be identical to a corresponding video time stamp. The client computer is capable of switching to a new displayable event together with a video frame or in between two video frames.

Drawing Description Text (5):
FIG. 4A is a flowchart illustrating the capture of a live video/audio stream from a video camera or from a previously stored video file.

Drawing Description Text (7):
FIG. 5 shows an exemplary format for storing and delivering a compressed video stream.

Drawing Description Text (11):
FIG. 9 illustrates one embodiment of the client computer which includes a web browser and a browser plug-in module for interfacing a web browser with a client module.

Detailed Description Text (13):
FIG. 2 is a block diagram showing an exemplary hardware environment for practicing the annotated video-on-demand (VOD) system of the present invention. The VOD system includes a production station 210, a stream server 220, at least one web server 230 and at least one client computer 240, each of which can be implemented using computer system 100 described above. Stream server 220 and web server 230 are coupled to client computer 240 via a computer network 290, e.g., the internet. Note that the disclosed hardware environment is exemplary. For example, production station 210 and stream server 220 can be implemented using two separate computer systems or using one computer system. In addition, if production station 210 and stream server 220 are implemented on separate computer systems as shown in FIG. 2, an optional direct connection (not shown) between production station 210 and stream server 220 can provide faster uploads of compressed video and annotation streams. In the following description, an audio stream optionally accompanies each video stream.

Detailed Description Text (14):
A producer 215, installed in production station 210, is a user-friendly tool for use by a designer 219 to create a synchronization script which includes annotation stream(s). The annotation stream(s) define the content(s) of a LiveScreen display 245 to be displayed on client computer 240 for a viewer 249. LiveScreen 245 display provides a graphical user interface (GUI) with multiple windows for synchronously displaying a video stream from stream server 220 and at least one displayable event stream. Examples of displayable events include textual/graphical information such as HTML--scripted web page(s) from web server 230.

Detailed Description Text (15):
In one embodiment, as shown in FIG. 3, producer 215 includes a capture module 317 and an author module 318. Production station 210 includes 16 MB of RAM and a 1 GB hard disk drive for capturing and storing an uncompressed or precompressed video stream. Sources for generating video streams include a video camera 312, a video cassette recorder (VCR) (not shown) or a previously digitized video file 314, e.g., a Video for Windows (.avi) file. For ease of installation and use by designer 219, producer 215 is implemented in a host environment which includes a window-based operating system such as Microsoft Windows 95 and a web browser such as Netscape's Navigator 3.x. (Appendix A is a detailed user manual for one implementation of producer 215).

Detailed Description Text (16):
Referring also to the flowchart of FIG. 4A, in step 410 capture module 317 captures a live video/audio stream from video camera 312 or from the previously stored video file 314. If video camera 312 provides an analog video stream, e.g., an NTSC signal, a hardware capture card (not shown) provides the required conversion from the analog video stream to a digitized video stream. Because temporary storage of uncompressed video data is memory intensive, some form of pre-compression can be used to reduce the memory storage requirement of the input video stream during capture step 410 and prior to compression step 420.

Detailed Description Text (17):
In step 420, capture module 420 compresses the digitized video stream using a suitable compression technique. In this embodiment, depending on the bandwidth capacity of the connection provided by network 290 between stream server 220 and client computer 240, e.g., a POTS modem, ISDN or Ethernet, a suitable frame resolution and frame rate combination is selected. A compression algorithm based on the H263 standard (see co-pending applications VXT 702 and 718) is used for compressing lower bandwidth video streams, e.g., at less than 56 kbps. Alteratively, a Vxpress format (see co-pending application VXT 712) is used for compressing higher bandwidth video streams. FIG. 5 shows an exemplary format 500 for storing and delivering a compressed video stream.

Detailed Description Text (21):
Designer 219 may view frames from video stream 500 displayed in video window 720 for referencing and selecting appropriate time stamps to use in generating annotation streams. Within video window 720, VCR function buttons, e.g., a rewind button 724, a

play button 726 and a fast forward button 728, are available for designer 219 to quickly traverse video stream 500. Since video window 720 is provided as a convenience for designer 219, if designer 219 has prior knowledge of the content of the video stream, designer 219 may proceed with the generation of the annotation streams without viewing video window 720.

Detailed Description Text (27):
In accordance with another aspect of the invention, LiveScreen display 600 also includes a table of contents (TOC) 630, enabling viewer 249 at client computer 240 to skip forward or backward to a point within the entire video/audio stream 500. TOC 630 include one or more content labels, each indexed to a corresponding time stamp in video stream 500, as defined by TOC time markers 791, 792, 793, 794 in LiveScreen display 600.

Detailed Description Text (28):
Referring now to FIG. 9, in one embodiment of the present invention, client computer 240 includes a web browser 950 and a browser plug-in module 952 for interfacing web browser 950 with a main client module 960. Client module 960 includes an event registry 962, playout buffer(s) 966, video/audio decoder(s) 964, video/audio renderer(s) 965 and one or more dynamically loadable event applet(s), e.g., flipper applet 967, ticker applet 968 and VCR applet 969. In this embodiment, event registry 962 also functions as an annotation interpreter 963.

Detailed Description Text (29):
FIG. 10A is a flowchart illustrating the operation of client module 960. Assume that viewer 249 has not previously loaded client module 960 in client computer 240, but has already loaded a web browser 950, e.g., Netscape's Navigator (step 1010). Viewer 249 surfs the world-wide web (www) via the internet and locates a web site of interest to viewer 249. Typically, the web site of interest is hosted on web server 230. Accordingly, a target web page is downloaded from web server 230 and displayed on client computer 240.

Detailed Description Text (30):
The target web page includes a link to a customized LiveScreen display, e.g., display 600. If client module 960 has not been previously loaded, client module 960 is now loaded over web browser 950 for processing video/audio and annotation streams (step 1020). Depending on the implementation, a copy of client module 960 may be available from the web site of interest. Alternatively, the target web page may provide a HTML link to another web server which has an updated copy of client module 960.

Detailed Description Text (31):
Referring now to FIG. 10B, first, browser plug-in module 952 is installed over web browser 950 (step 1022). As discussed above, plug-in module 952 provides the interface between client module 960 and web browser 950. The target web page provides a HTML link to the format for LiveScreen display 600. The LiveScreen display format is retrieved and display 600 is installed on client computer 240 using web browser 950 (step 1024).

Detailed Description Text (33):
Referring back to FIG. 10A, encoded video/audio frames and associated annotation frames are streamed from stream server 220 to client computer 240 for synchronous display (step 1030). Streaming video and audio streams over a network is very efficient because streaming eliminates the need for a large buffer at client computer 240. In addition, streaming also provides flexibility, e.g., switching video sources midstream is possible without wasting network resources since streaming is based on a pseudo just-in-time (JIT) protocol and does not involve downloads of the entire video stream prior to display at client computer 240. If the underlying transmission protocol is HTTP, then video, audio and annotation packets are initially "pulled" by client computer 240 from server 220 using HTML "get" packet(s).

Detailed Description Text (34):
Next, the encoded video/audio streams are decoded by decoder 964, i.e., decompressed using a suitable technique, and then displayed at client computer 240 by renderer 965 (step 1040). (See co-pending applications VXT 702, 712 and 718).

Detailed Description Text (37):
Further, since the video and annotation streams are handled synchronously but separately by video decoder 964 and annotation interpreter 963, respectively, steps 1040 and 1050 can occur concurrently or consecutively. As discussed above, event registry 962 is capable of dynamic registration of event applets. Accordingly,

annotation interpreter 963 is adaptable, and capable of automatic installation and linking of new event applet(s) to add new class(es) of displayable events for client computer 240.

Detailed Description Text (38):
After registering with event registry 962, flipper applet 967 provides the location of the flipper stream to browser 950 which then begin receiving the flipper steam from stream server 220. Flipper annotation frames are provided by stream server 220 synchronously with the video/audio frames to client module 960 so that the annotations, i.e., displayable events can be synchronized for display at client computer 240 (step 1060). In this example, URL addresses, for synchronizing HTML page flips with video stream are provided to web browser 950 thereby permitting client computer 240 to subsequently retrieve and display various textual and graphical elements changing at predetermined points corresponding to the timeline of the video stream. Note that HTML pages can be retrieved from one or more web server(s) 230.

Detailed Description Text (39):
Similarly, after registering with event registry 962, ticker (tape) applet 968 provides the location of the ticker stream to browser 950 which then begins receiving the ticker stream from stream server 220. Ticker annotation frames are provided by stream server 220 synchronously with the video/audio frames so that the annotations, i.e., displayable ticker data can be synchronized for display at client computer 240 at predetermined points corresponding to the timeline of the video stream.

Detailed Description Text (42):
As shown in FIG. 11, a table of content 630 with content labels enables viewer 249 to skip forward or backward to predetermined locations in the video/audio stream. First, viewer 249 selects a content label of interest (step 1110). Examples of suitable content labels are section headings of the video stream. Next, client module 960 sends a message to stream server 220 with the time stamp of an I-frame from the video stream whose location is close to selected content label (step 1120). In this embodiment, an I-frame is a video frame which includes data for a complete video frame. Although computationally more intensive, it is also possible to select a P-frame and then reconstructed a complete video starting from a neighboring I-frame close to the selected P-frame.

Other Reference Publication (1):
"Web Theater Producer User Guide, Version 2.0", Palo Alto, CA: VXtreme, Inc., (1997).

CLAIMS:

1. A computer-readable medium useful in association with a client computer having a display device, the computer-readable medium having computer-executable instructions which cause the computer system to perform a method comprising:

receiving a video stream from a stream server coupled to the client computer via a computer network, said video stream including a plurality of video frames, each said video frame including a time stamp;

sequentially displaying said video frames on said display device, starting from an initial video frame of said video stream;

selecting a content label from a table of contents displayed on said display device, said content label providing an index into an intermediate video frame of said video stream, said index based on the time stamp of said intermediate video frame;

communicating said index to said stream server;

receiving said video stream from said stream server, starting from said intermediate video frame; and

sequentially displaying said video frames on said display device, starting with said intermediate video frame.

2. A computer-readable medium useful in association with a stream server, said stream server coupled to a client computer via a computer network, said client computer including a display device, the computer-readable medium having computer-executable instructions which cause the stream server to perform a method comprising:

streaming said video stream to said client computer for sequential display on said display device, starting from an initial video frame of a plurality of video frames of said video stream, each said video frame including a time stamp;

receiving an index from said client computer, said index associated with a selectable content label from a table of contents displayed on said display device, said index based on the time stamp of an intermediate video frame of said video stream; and

streaming said video stream to said client computer for sequential display on said display device, starting from said intermediate video frame.

15. A computer-readable medium useful in association with a client computer having a display device, the computer-readable medium comprising:

receiving a video stream from a stream server coupled to the client computer via a computer network, said video stream including a plurality of video frames, each said video frame including a time stamp;

sequentially displaying said video frames on said display device, starting from an initial video frame of said video stream;

selecting a content label from a table of contents displayed on said display device;

locating an I-frame in the video stream that is closest to the content label, wherein the I-frame has an associated timestamp;

communicating said associated timestamp to said stream server;

receiving said video stream from said stream server, starting from said intermediate video frame; and

sequentially displaying said video frames on said display device, starting with said intermediate video frame.

17. The client computer of claim 16, wherein the stream of data includes a video stream.

18. The client computer of claim 17, wherein the stream of data further includes an annotation stream associated with the video stream.

Generate Collection

L10: Entry 11 of 26 File: USPT Sep 18, 2001

DOCUMENT-IDENTIFIER: US 6292834 B1
**** See image for Certificate of Correction ****
TITLE: Dynamic bandwidth selection for efficient transmission of multimedia streams in a computer network

Application Filing Date (1):
19970314

Parent Case Text (2):
This application is related to U.S. application Ser. No. 08/818,805, filed on Mar. 14, 1997, entitled "Method and Apparatus for Implementing Motion Detection in Video Compression," U.S. application Ser. No. 08/819,507, filed Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method," U.S. application Ser. No. 08/818,804, filed on Mar. 14, 1997, entitled "Production of a Video Stream with Synchronized Annotations over a Computer Network," U.S. application Ser. No. 08/819,586, filed on Mar. 14, 1997, entitled "Method and apparatus for Implementing Control Functions in a Streamed Video Display System," U.S. application Ser. No. 08/818,769, filed on Mar. 14, 1997, entitled "Method and apparatus for Automatically Detecting Protocols in a Computer Network," U.S. application Ser. No. 08/818,127, filed on Mar. 14, 1997, entitled "Dynamic Bandwidth Selection for Efficient Transmission of Multimedia Streams in a Computer Network," U.S. application Ser. No. 08/819,585, filed on Mar. 14, 1997, entitled "Streaming and Display of a Video Stream with Synchronized Annotations over a Computer Network," U.S. application Ser. No. 08/818,664, filed on Mar. 14, 1997, entitled "Selective Retransmission for Efficient and Reliable Streaming of Multimedia Packets in a Computer Network," U.S application Ser. No. 08/819,579, filed Mar. 14, 1997, entitled "Method and apparatus for Table-Based Compression with Embedded Coding," U.S. application Ser. No. 08/819,587, filed Mar. 14, 1997, entitled "Method and apparatus for Implementing Motion Estimation in Video Compression," U.S. application Ser. No. 08/818,826, filed on Mar. 14, 1997, entitled "Digital Video Signal Encoder and Encoding Method," all filed concurrently herewith, U.S. application Ser. No. 08/822,156, filed on Mar. 17, 1997, entitled "Method and apparatus for Communication Media Commands and Data Using the HTTP Protocol," U.S. provisional application Serial No. 60/036, 662, filed on Jan. 30, 1997, entitled "Methods and apparatus for Autodetecting Protocols in a Computer Network," U.S. application Ser. No. 08/625,650, filed on Mar. 29, 1996, entitled "Table-Based Low-Level Image Classification System," U.S. application Ser. No. 08/714,447, filed on Sep. 16, 1996, entitled "Multimedia Compression System with Additive Temporal Layers," and is a continuation-in-part of U.S. application Ser. No. 08/623,299, filed on Mar. 28, 1996, entitled "Table-Based Compression with Embedded Coding," which are all incorporated by reference in their entirety for all purposes.

Brief Summary Text (13):
The present invention provides efficient transmission of multimedia streams from a server to a client computer over a diverse computer network including local area networks (LANs) and wide area networks (WANs) such as the internet. Examples of multimedia streams provided to the client computer include a compressed video stream, a compressed audio stream, and an annotation stream with pointers to textual/graphical data in the form of HTML pages.

Drawing Description Text (4):
FIG. 3 is a block diagram showing a producer which includes a capture module and an author module for capturing video streams and for generating annotation streams, respectively.

Detailed Description Text (13):
FIG. 2 is a block diagram showing an exemplary hardware environment for practicing the reliable and efficient video-on-demand (VOD) system of the present invention. The VOD

system includes a production station 210, a stream server 220, at least one web server 230 and at least one client computer 240, each of which can be implemented using computer system 100 described above. Stream server 220 and web server 230 are coupled to client computer 240 via a computer network 290, e.g., the internet. Note that the disclosed hardware environment is exemplary. For example, production station 210 and stream server 220 can be implemented using two separate computer systems or using one computer system. In addition, if production station 210 and stream server 220 are implemented on separate computer systems as shown in FIG. 2, an optional direct connection (not shown) between production station 210 and stream server 220 can provide faster uploads of compressed video and annotation streams. In the following description, an audio stream optionally accompanies each video stream.

Detailed Description Text (14):
A producer 215, installed in production station 210, is a user-friendly tool for use by a designer 219 to create a synchronization script which includes annotation stream(s). The annotation stream(s) define the content(s) of a LiveScreen display 245 to be displayed on client computer 240 for a viewer 249. LiveScreen 245 display provides a graphical user interface (GUI) with multiple windows for synchronously displaying a video stream from stream server 220 and at least one displayable event stream. Examples of displayable events include textual/graphical information such as HTML-scripted web page(s) from web server 230.

Detailed Description Text (15):
Referring to FIG. 3, producer 215 includes a capture module 317 and an author module 318. Production station 210 includes 16 MB of RAM and a 1 GB hard disk drive for capturing and storing an uncompressed or precompressed video stream. Sources for generating video streams include a video camera 312, a video cassette recorder (VCR) (not shown) or a previously digitized video file 314, e.g., a Video for Windows (.avi) file. For ease of installation and use by designer 219, producer 215 is implemented in a host environment which includes a window-based operating system such as Microsoft Windows 95 and a web browser such as Netscape's Navigator 2.x.

Detailed Description Text (16):
Client computer 240 in FIG. 3 includes a web browser 350 and a browser plug-in module 352 for interfacing web browser 350 with a main client module 360. Client module 360 includes an event registry 362, video/audio decoder(s) 364, video/audio renderer(s) 365, playout buffer(s) 366, and one or more dynamically loadable event applet(s), e.g., flipper applet 367, ticker applet 368 and VCR applet 369. In this embodiment, event registry 362 also functions as an annotation interpreter 363.

Detailed Description Text (18):
The present invention is directed at the efficient and reliable streaming of data packets from stream server 220 to client computer 240, accomplished by optimally utilizing the bandwidth of the connection provided by computer network 290 while minimizing the loss of packets. In one embodiment, the transmission rate of the data stream is dynamically adjusted in response to changes in the bandwidth made available by computer network 290 for the network connection between server 220 and client computer 240. Accordingly, server 220, in response to feedback from client computer 240, dynamically selects transmission rates in order to better match the varying bandwidth capacity of the network connection. For example, server 220 streams video packets at 1 frames/second (fps), 5 fps, 10 fps, and 15 fps for bandwidths of 4 kbits/second (kbps), 14 kbps, 18 kbps, and 44 kbps.

Other Reference Publication (4):
"Web Theater Product User Guide, Version 2.0", Palo Alto, CA: VXtreme, Inc., (1997).

CLAIMS:

4. The method of claim 1 wherein said data stream is a video data stream.

12. The method of claim 7 wherein said data stream is a video data stream.

18. The client computer of claim 15 wherein said data stream is a video data stream.

26. The client computer of claim 21 wherein said data stream is a video data stream.

32. The computer-readable medium of claim 29 wherein said data stream is a video data stream.

40. The computer-readable medium of claim 35 wherein said data stream is a video data stream.

WEST

Generate Collection

L10: Entry 9 of 26 File: USPT Apr 2, 2002

DOCUMENT-IDENTIFIER: US 6366914 B1
TITLE: Audiovisual content distribution system

Abstract Text (1):
A digital department system is disclosed. The digital department system of the present invention includes a network management center, a network operating center that is coupled to the network management center, a multimedia server, a multicasting transmission medium coupling the network operating center and the multimedia server, a listening post coupled to the multimedia server by the network, and one or more audio/video display capable of displaying video and capable of playing audio, the audio video display coupled to the multimedia server by the network. The audio and video content are stored in digitized files on the multimedia server for distribution throughout the site via the network.

Application Filing Date (1):
19980807

Brief Summary Text (13):
In one embodiment of the present invention, a digital department system is provided. The digital department system of the present invention includes a network management center, a network operating center that is coupled to the network management center, a multimedia server, a multicasting transmission medium coupling the network operating center and the multimedia server, a listening post coupled to the multimedia server by the network, and one or more audio/video display capable of displaying video and capable of playing audio, the audio video display coupled to the multimedia server by the network. The audio and video content are stored in digitized files on the multimedia server for distribution throughout the site via the network.

Detailed Description Text (12):
NMC 110 maintains a catalog (database) of products for preview. NMC 110, in accumulating and compiling this information, also digitizes this information and provides it to a Network Operations Center (NOC) 120 in the form of digitized data files 122. It will be noted that data files 122, although referred to in terms of digitized audiovisual content, can also be streaming audio, streaming video, or other such information. Each product may have associated digital files containing information pertaining to the product. Alternatively, all the information may be compiled into one file. Following are examples of the types of files/information that may be catalogued and maintained:

Detailed Description Text (75):
One example of a multicasting technique is the Multicast File Transfer Protocol (MFTP) from Starburst.TM.. This protocol is described in great detail in the specification entitle "STARBURST MULTICAST FILE TRANSFER PROTOCOL (MFTP) SPECIFICATION," (filename: draft-miller-mftp-spec-03.txt; dated April, 1998) which can be viewed at the time of this writing at the following universal resource locator on the World Wide Web:

Detailed Description Text (89):
Receiver/decoder 135 is capable of receiving, processing, and providing voice, video, data, and other forms of information to various devices within commercial sales outlet 130. While the configuration of the communications network 125 (and in particular, transmitting station 121, receiving station 128, and receiver/decoder 135) will vary according to the technology used to distribute digital data files 122. For example, while transmitting station 121 and receiving station 128 are described in terms of a satellite network, one of skill in the art will recognize that these elements could support broadcast or duplex communications systems. These elements could therefore be satellite transmitters/receiver pairs, a multicast network, a UUCP (Unix-to-Unix CoPy) network, or the like. Alternatively, these elements could be network interface cards,

microwave transceivers, infrared transceivers, or the like. In this example, a satellite broadcasting system is employed. Transmitting station 121 and satellite 127 are implemented using commercially available satellite communication technology, and so are not described in detail herein.

Detailed Description Text (129):
Receiver/decoder 135 is preferably capable of receiving both digital and analog information. With regard to data reception and distribution, receiver/decoder 135 is connected to various network nodes in commercial sales outlet 130 via a network system 150. Network 150, while it may be directly connected to various other nodes in commercial sales outlet 130 is connected in FIG. 1B to multimedia server 160, as noted. For most of data files 122, once they are received by receiving station 128 at commercial sales outlet 130, they are passed to receiver/decoder 135, which in turn passes them on to multimedia server 160. Multimedia server 160 is connected via the network (e.g., an ether network using a TCP/IP protocol stack, and using FTP file transfers to distribute the promotional information) to various nodes in commercial sales outlet 130. These nodes include (but are not limited to) an in-line home video station 161, an in-line computer hardware and software interactive display 165, an in-store radio system 170, a wall-of-eyes 180 (which may be connected to either multimedia server 160, or to receiver/decoder 135 via a video switch 175, which is optional), listening posts 185, audio/video endcaps 190, audio/video endcaps in other departments 195, on-line services 200 and an entity LAN 210. Entity LAN 210 may be connected to an on-line internet commerce access system 220, a UNIX server 230 and/or a CBL server 240, among other such possible connections.

Detailed Description Text (310):
As noted, data sent via communications network 125 can be of several types. For example, receiver/decoder 135 may provide audiovisual training information to video cassette recorder (VCR) 140 via the direct video capabilities that communications network 125 may support (e.g., real-time analog, high-definition television (HDTV), or digital video information). Training VCR 140 allows such audiovisual information to be recorded for later playback, to allow the audiovisual information to be replayed for off-line training or during multiple training sessions.

WEST

Generate Collection

L10: Entry 8 of 26 File: USPT Apr 9, 2002

DOCUMENT-IDENTIFIER: US 6370487 B1
** See image for Certificate of Correction **
TITLE: Remote semiconductor microscopy

Application Filing Date (1):
19990423

Detailed Description Text (11):
In yet another embodiment, the digitized frames of analog video 122 are streamed over the network 106 from the server 104 to the clients 102. In a further embodiment, the streaming video format can be the Advanced Streaming Format (ASF) (Microsoft.RTM. Corporation, Redmond, Wash.), further described in a document published by Microsoft.RTM. Corporation and Real Networks.TM., Inc., entitled Advanced Streaming Format (ASF) Specification, Feb. 11, 1998, hereby incorporated by reference, and which may be found on the World Wide Web at http://www.microsoft.com/ asf/whitepr/asfwp.htm. Frames of digitized video data 122 are streamed in the ASF format by Netshow Server software operating on the server 104. The ASF video is played on the clients 102 by Netshow Player software. Netshow software is also a product of Microsoft.RTM. Corporation (Redmond, Wash.). However, the present invention can utilize other client-server streaming software, such as Real Video by Real Networks, Inc. (Seattle, Wash.).

CLAIMS:

2. The inspection system of claim 1 wherein the server streams the digitized video signal to the client computers.

6. The inspection system of claim 1, wherein the video capture system includes an encoder-decoder (CODEC) to compress the digitized video signals.

14. The semiconductor wafer microscopy system of claim 10, wherein the video capture system streams the digitized video signal to the client computer.

23. The method of claim 22 wherein communicating the digitized video signal includes streaming the video signal.

30. The computer-readable medium of claim 29 wherein communicating the digitized video signal includes streaming the video signal.

Generate Collection

L10: Entry 7 of 26 File: USPT Jul 16, 2002

DOCUMENT-IDENTIFIER: US 6421726 B1
TITLE: System and method for selection and retrieval of diverse types of video data on a computer network

Application Filing Date (1):
19980301

Brief Summary Text (4):
The Internet is growing, in terms of both size and sophistication, at a rapid rate. In the past, most users of the Internet were academic, research, or institutional users; the Internet was primarily used at that time to transmit and receive electronic mail and network news and to allow transfer of computer files. However, since the introduction of the World Wide Web (also known as the "Web" or the "WWW") several years ago, the Internet has begun to host increasing amounts of other types of data of general interest, namely representations of images, articles, etc.

Brief Summary Text (5):
The Web protocol and language establish a graphical means to navigate the expanses of the Internet. "Web pages," often consisting primarily of text and graphical material, are stored on numerous computers, known as "Web servers," throughout the Internet. A software program known as a "browser" can be used to access and view Web pages across the Internet by specifying the location (i.e. Internet address) of the desired Web page. When a Web page is accessed, its information is transmitted from the remote computer (server or delivery site), wherever in the world it may be located, across the Internet, to the user.

Brief Summary Text (6):
In recent times, the Web has begun to host highly sophisticated types of multimedia content, such as audio and video data, and computer software. Compared to first generation Web content, namely text and still images, audio clips, video clips, and software programs have extremely high storage and bandwidth requirements.

Brief Summary Text (7):
Before a video clip can be transmitted over a computer network, the clip must be digitized by encoding the video's analog signal to "1s" and "0s." In order to reduce the bandwidth required to transmit the digitized video, the video data stream is frequently compressed. Video compression is a process by which redundant data is eliminated from the video data stream so that the overall size of the data stream is reduced. There are many different compression formats which are used to reduce video data streams, e.g., MPEG, JPEG, H261, Indeo, Cinepak, AVI, Quicktime, TrueMotion and Wavelet.

Brief Summary Text (8):
Video clips received in a compressed format generally s must be decompressed before they can be viewed. Decompression of a video is commonly performed by a video player "CODEC" program, or COmpressor/DECompressor, often located at a user's multimedia terminal. Generally speaking, a single CODEC program can only recognize and decompress a single compression format.

Brief Summary Text (18):
As discussed above, a browser program can be used to access and view Web pages across the Internet by specifying the location (i.e. Internet address) of the desired Web page, or more commonly, by "hotlinking" to Web pages. Common browsers are Lynx, NCSA Mosaic, Netscape Navigator, and Microsoft Internet Explorer. The desired Web page is specified by a uniform resource locator ("URL"), indicating the precise location of the file using the syntax "http://internet.address/directory/filename.html".

Brief Summary Text (19):
Web pages are generally described, in terms of layout and content, by way of a language known as "HTML" (HyperText Markup Language). Any particular computer linked to the Internet can store one or more Web pages, i.e. computer files in HTML format, for access by users.

Brief Summary Text (20):
Hotlinking from one HTML Web page to another is accomplished as follows. The user first accesses a Web page having a known address, often on the computer located at the user's ISP (Internet Service Provider). The ISP is the organization providing Internet connectivity to the user. That Web page can contain, in addition to textual and visual data specified in HTML format, "links," or embedded information (in the form of URLs) pointing to the Internet addresses of other Web pages, often on other computers throughout the Internet. The user, by selecting a link (often by pointing and clicking with a mouse), can then access other Web pages, which can in turn contain further data and/or additional links.

Brief Summary Text (21):
Various extensions to HTML, such as Netscape's EMBED tag, allow references to other data to be embedded into Web pages. Some browsers are not capable of handling data other than text and images. Other browsers can handle the data in various ways. NCSA Mosaic, for example, handles references to unknown types of data by allowing the data to be downloaded to the user's computer, and then optionally invoking an external program to view or manipulate the data. Recent releases of Netscape Navigator and Microsoft Internet Explorer take the concept one step further: a browser extension, or "plug-in," can be automatically invoked to handle the data as it is received from the remote Web page. Other means, such as network program "applets" written in the Java language (or a similar language), can be used to extend the functionality of the browser environment or network.

Brief Summary Text (23):
The network design compromises discussed above generally adversely impact the transmission of audio and video data across the Internet. While a user using a browser to "surf" the Web might not notice minor delays and transmission rate variations while retrieving text and still images, such defects become apparent and significant when real-time audio and video information is accessed.

Brief Summary Text (24):
In an attempt to solve these problems, Internet content providers sometimes spread popular content around the Internet on various servers or delivery sites known as "mirror sites." Each mirror site contains information that is essentially identical to that of the original site. For example, if a popular Web site is located in New York, mirror sites might be located in Los Angeles, London, and Tokyo. Accordingly, if a European user is having difficulty accessing the original New York site, he can hotlink to the mirror site that is geographically closest, i.e. London.

Brief Summary Text (27):
Moreover, mirror sites are often hosted on a voluntary basis. If a Web site is extremely popular, and a service provider determines that the subject matter might be of interest to its subscribers, that service provider might agree to host a mirror site of the original Web site. Such an arrangement would be attractive to host of the mirror site because people would be drawn to the mirror site, and might hotlink to other content hosted there. On the other hand, such voluntary alliances typically are not reliable and might be severed at any time.

Brief Summary Text (29):
Currently, there is no guidance in selecting optimal locations for delivery sites, nor is there a known method permitting a user to determine which mirror site to connect to that will ensure optimum performance. In fact, the use of a traditional mirror site is voluntary. Typically, a user will try to access the original site (or a known mirror site), and will switch to another mirror site only if performance is found to be insufficient after one or more attempts. This approach is an inefficient utilization of network resources. Clearly, mirror sites are not an optimum solution to the problem of overloaded Web sites. A principal reason for this, among others, is the failure to consider network performance.

Brief Summary Text (36):
The invention is directed to a system and method for the optimized distribution of Web content to and from sites located around the Internet. An intelligent mirroring scheme,

called here "Smart Mirroring," is used to determine the need for and distribution of mirror sites and to direct user requests for certain Web content to an optimum mirror site. A format selection scheme is used to automatically select a video clip file compressed in a format recognized by a CODEC program already installed and operative on a user terminal.

Brief Summary Text (37):
A number of "smart" delivery or mirror sites are used to distribute popular Web content to various parts of the Internet. A comprehensive scheme of network analysis, based on tests performed by a large number of users, is used to interactively determine the preferred locations for the sites, and to determine the optimum sites to be used by each individual user.

Brief Summary Text (40):
A system according to the invention begins with an original Web site and at least one additional delivery (or mirror) site. Each user desiring to use the system will be provided, in a preferred embodiment, with software which includes a configuration utility and a client program. The configuration utility is used first to determine which delivery sites provide improved performance for that particular user.

Brief Summary Text (42):
The configuration utility will run a subset of the tests specified in the delivery site file. The test results show which delivery sites yield improved performance for the user, and also contain information on various generalized network capabilities from the standpoint of the user running the tests. The network test results and the identity of the chosen delivery site will be sent (via e-mail in one possible configuration) back to the delivery service provider for incorporation into the service provider's database.

Brief Summary Text (43):
The delivery site chosen by the configuration utility is then used by that user for the retrieval of all content managed by the delivery system service provider. Consequently, when the user is browsing Web content, and finds a particular item, e.g. a video clip, that is managed by the service provider's delivery system, the client software will automatically retrieve it from the specified "Smart Mirror" delivery site. Site preferences and default sites can be updated periodically on request, at specified times, or in response to changes in network load and traffic.

Brief Summary Text (46):
A Web page hosting an embedded video clip also includes code to activate the Smart Mirroring and format selection schemes. Accordingly, a video clip selection and retrieval system according to the invention stores each video clip at various locations in a number of different compression formats. A format selection module comprises software programs that instruct the user terminal to determine which CODEC programs are installed at a user terminal, select a preferred CODEC for use, locate video clips stored in a compression format recognized by the preferred CODEC, and redirect or modify a video request so the video delivery system can locate and retrieve the desired clip. Where no appropriate CODEC is detected, the format selection module prompts the user to download and install a preferred CODEC.

Brief Summary Text (47):
In a first embodiment of the format selection module, a video clip is stored in a number of different compression formats at individual delivery sites connected to the Internet. The video clip and its address are referenced on a Web page providing access to the server. The Web page also contains an embedded software program for querying the user terminal to determine what CODECs are installed at the terminal. The embedded program is automatically executed when the user requests a video clip which is referenced on the Web page. If the query detects the presence of a CODEC that can decompress a video clip stored by one of the servers, the embedded program will select that CODEC and request the appropriate video clip.

Detailed Description Text (8):
For the purposes of describing this invention, a delivery site is a "node" on the network which may store data or other files, such as software code, for delivery. The term can also include a site which is responsible for data delivery, including mirror sites, content providers, and servers for broadcast video streams or Web sites.

Detailed Description Text (17):
The configuration utility 34 then queries the user (step 42) for various items of

information needed in the configuration process, for example, the user's name, e-mail address, password, modem speed, and information related to access control (e.g. what levels of various attributes are viewable by the user). The access control mechanism will be discussed in further detail below. In one embodiment of the invention, the information received from the user is encrypted and stored in a configuration file on the user terminal 12.

Detailed Description Text (33):
In one embodiment of the invention, a proprietary graphical interface is provided so that the location of the user and the locations (both geographic and electronic) of each site tested can be displayed on a monitor connected to the user terminal 12, allowing a visual indication of the relative distances between sites. In one embodiment, the display is shown in the form of a "radar screen," upon which the user terminal 12 and delivery sites are displayed as "blips" superimposed over a map of the pertinent geographical region. In order to encourage the user to use the application and to offer more network-wide data, the user interface can allow the user to enter an "ad-hoc" test site for additional performance testing. In this case, the configuration utility will test either the default Web page file (e.g., "index.html") or a specific file requested by the user. Analysis results from the user-selected site are adjusted so that reasonable comparisons can be made with results from other sites.

Detailed Description Text (36):
After a Smart Mirror site is selected, certain data will be sent to the MSP 32 (step 52) via e-mail or other Internet electronic protocol. The information received by querying the user, the identity of the selected Smart Mirror site, and all raw test data and results, including the time and date at which each test was run, is compiled into a text file (which is encrypted in one embodiment). Upon receipt by the MSP 32, the data is stored in a database for use in managing and analyzing the system.

Detailed Description Text (38):
It should be noted that in the operation of the system, the MSP 32 performs certain functions. The MSP 32 maintains the delivery site list, adding and deleting sites as necessary. The MSP 32 also maintains the database of network performance, containing information received via e-mail or other means from users running the configuration utility 34. As large amounts of data are received from numerous users, the database can provide valuable information on the performance and other characteristics of the Internet and portions thereof. Various data processing techniques are known to derive such information.

Detailed Description Text (43):
In one embodiment of the invention, the Smart Mirror system is used to locate a delivery site from which to download a video or audio clip ("clip") referenced on a Web page. In this embodiment, the client program can be referred to or considered a "player program." The player program, in addition to carrying out the functions of the client program 36, enables the retrieval and playback of video data. Ordinarily, a browser program 38 is run on the user terminal 12 to view Web content. Browser programs typically used include NCSA Mosaic, Netscape Navigator, and Microsoft Internet Explorer. The browser program 38 allows the user to hotlink among various Web sites on the Internet.

Detailed Description Text (44):
The EMBED tag is used within HTML documents to indicate which Web pages include content managed by the system. When the browser program 38 receives a Web page containing an EMBED tag, a download of the file referenced by the tag is commenced, and the file type is analyzed. If the file is of a type handled by the player program 36, e.g. MPEG, the browser program 38 initiates the player program 36. The contents of the tag are then passed by the browser program 38 to the player program 36.

Detailed Description Text (47):
If the player program 36 determines that the EMBED tag references a video clip or other content handled by the system (step 62), the transfer of the embedded clip from the content provider 22 is stopped. The player program 36 then extracts access control or rating information from the EMBED statement (step 64), if any exists. This rating information is compared against the reference levels stored in the configuration file stored at the user terminal 12 (step 66). If rating information does not exist for the clip, the configuration file is queried to determine whether unrated clips, as defined below, may be played (step 68). Based on the foregoing information, the player program 36 will authorize or decline the viewing of the desired clip.

Detailed Description Text (52):
If the player program 36 determines that the EMBED tag references a video clip or other content not handled by the system, the player will check whether the access control level set in the configuration file allows the user to play these clips or other files which are considered "unrated" (step 92). If so, the clip is transferred from its original content provider 22 by traditional means (step 94), and the player program 36 displays the downloaded file (step 96). If not, the player prevents the clip from being transferred (step 98) and displays a message (step 100) advising the user that the download is not permitted.

Detailed Description Text (64):
A Web page embedding a reference to a video clip for use with the invention, as described in FIG. 4, also includes an embedded software program. This software program can be written in the JavaScript language, which is known in the art and compatible with a number of Web browsers presently available, including Netscape Navigator and Microsoft Internet Explorer.

Detailed Description Text (65):
First, the Web page containing the video clip is loaded by the user terminal (step 120). The embedded software program "script" is then read and interpreted (step 122) by the browser.

Detailed Description Text (75):
First the Web page containing the video clip is loaded by the user terminal (step 160). The embedded software program "script" is then read and interpreted (step 161).

Detailed Description Text (84):
If the clip is downloaded directly (and the redirector features are not available), the clip is played by traditional means. However, the format selection plug-in may have associated with it a configuration file, containing a listing of delivery sites containing the video clips managed by the invention. Instead of using the URL stored on the Web page for the download of a clip, the plug-in can make a random selection from the list of delivery sites, and append the name of the clip and the preferred format type to that selected delivery site. The download can then take place (step 194) from the randomly selected delivery site. While this does not accomplish the Smart Mirroring method, it does accomplish a certain level of load distribution. Although the choice made at a particular user terminal might not be optimum for that terminal, video clip demand will be spread over a plurality of delivery sites.

Other Reference Publication (1):
Baentsch, M. et al. "Introducing application-level replication and naming into today's Web," Computer Networks and ISDN Systems, vol. 28, No. 11 (May 1996).

Other Reference Publication (3):
Braun, H. et al., "Web traffic characterization: an assessment of the impact of caching documents from NCSA's web server," Computer Networks and ISDN Systems, vol. 28, No. 1 (Dec. 1995).